NEW SERIES, VOL. XLVIII MAY, 1940 NO. 2

The American Journal of Surgery

Copyright, 1940 by The American Journal of Surgery, Inc.

A PRACTICAL JOURNAL BUILT ON MERIT

EDITORIAL

THE CONTRIBUTION OF DOG SURGERY TO THE SELF DEVELOPMENT OF THE PRACTICING SURGEON

SMALL town surgeons can easily provide themselves with facilities in their own community for practice in operating technique by utilizing dogs. A few years ago while we were engaged in postgraduate study we acquired enthusiasm for the surgical practice to be gained by operations performed on the dog. The money and time required to do this away from home, and the desirability of having opportunity for such experience from week to week, both for developing manual dexterity and for experimenting with new materials and techniques, led us to establish a set-up of our own for work of this sort. For the past eighteen months we have met one morning a week in the basement of an isolated home and have operated upon dogs for from four to six hours at a time.

Emphasis on preoperative diagnosis and preparation, surgical pathologic judgment, and postoperative care has given added meaning to the remark that "a surgeon is an internist who operates." But any man who operates knows that technical skill comes only with experience in performing operations. Such experience is never complete, for there are always new procedures to try, new ways of doing the old procedures, and new instruments and materials with which to work.

Recently, on a visit to some of the surgical centers of the east, we found that not only were the residents and younger surgeons availing themselves of dogs for surgical practice, but that more experienced men were also making active use of this type of training. To be sure, most of them had access to the dog surgery laboratories of undergraduate and postgraduate medical schools. They felt that it afforded a quite valuable adjunct to their own practice in surgery, and appeared to be interested that such a procedure was being used in a small community.

Dog surgery has been valuable to us because it has afforded opportunity for extensive experience in the use of instruments and suture materials, in the handling of living tissues, and in experimenting with unfamiliar operative procedures. It has given us what every surgeon covets—the opportunity to practice a wide variety of techniques, to develop ambidexterity, and to learn to think of technical problems which arise in the course of an operation in terms of tissues instead of personalities.

Some of the procedures which we have found practical in this work follow:

The abdominal wall of the dog resembles that in man, and leads itself quite well to experimentation with the various types of incisions described in the literature. The

anterior suprerior spine of the ilium is not so well defined as in man, but it is quite possible to demonstrate the structures pertaining to the two types of inguinal hernia and practice the repair of these tissues.

With the abdomen open in its upper portion the stomach is available for virtually every procedure which is carried out in the human patient. The cardia is somewhat less accessible in the dog due to the more conical shape of the diaphragm. This makes the procedure of total and subtotal gastric resection slightly more difficult. In the subtotal resection both the complete and partial stomas are employed. We find that these are among the most valuable operations that can be practiced on the dog.

The various types of gastrotomy and gastrostomy are performed, including the Spivack tubovalvular gastrostomy which provides, for a patient who has suffered obliteration of the esophagus, a mucous membrane lined tube through which feeding can be given without regurgitation of fluids through the tube. This operation can be performed on the dog, the cardia and pylorus tied off, and the stomach filled with a quart or more of water through a catheter in the gastrostomy tube. The catheter is withdrawn and the dog turned over. None of the water escapes from the stomach.

The various types of gastroenterostomy and pyloroplasty are also suitable for this work. There is no gastrocolic ligament in the dog; the dorsal mesogastrium forms a greater omentum but does not attach to the colon. However, in performing posterior gastroenterostomy a hole can be made in the mesocolon and the posterior stomach wall brought to this opening in the same manner as through a gastrocolic attachment were present.

The small bowel is ideal for practicing blind end closure, intestinal resection, and both open and closed methods of anastomosis, including lateral, end-to-end, and end-to-side. The wall of the bowel is slightly thicker and the lumen somewhat smaller than in man, and in some animals more friable. This gives one the feeling that a procedure successfully carried out on these tissues is even more certain when done on the human patient. A young surgeon's first intestinal anastomosis is usually very clumsily done. Skill in this operation had much better be developed at the expense of the dog than at the expense of the patient.

The large bowel and the appendix are thick walled and for the most part distended with hard, dry feces, rendering them largely unsuitable for use. The appendix itself is usually about 1½ to 2 inches long and ½ to ¾ inch in diameter.

The gall-bladder is suitable for nearly any procedure carried out on the human patient including cholecystotomy, cholecystostomy, cholecystectomy, and anastomosis to the stomach and duodenum. The common bile duct is rather small but its surgical treatment affords good practice.

The kidneys lie virtually within the peritoneal cavity and hence are not accessible by the extraperitoneal route. Indeed the peritoneum and the fascia transversalis are so thin that it is almost impossible to make an extraperitoneal approach to the ureters and other retroperitoneal structures. Through the abdomen, however, the ureters are readily available for end-to-end anastomosis and implantation into the bladder or bowel.

The uterus in the dog is a thin, Y-shaped, bicornuate structure and of no value to the gynecologist.

The thyroid gland, unfortunately, is very small and of little surgical value.

Thoracic surgery which has made such strides in the last ten years is usually possible in man without an artificial respirator. This is due to the fact that the human mediastinum is sufficiently rigid to permit, in most cases, opening the thorax and collapsing the lung on one side without serious respiratory embarrassment; only occasionally is it necessary to use positive pressure in the form of a tight mask and gas machine. In the dog, however, due to a thin, friable mediastinum, it is impossible

to expose the heart and one lung without collapsing both lungs. This problem has led us to develop a machine for positive pressure respiration for the dog, given by way of an intratracheal cannula. Lobectomy, pneumonectomy, and cardiac surgery have thus been added to the techniques available.

The respirator consists of a motor driven crank, stepped down until the crank makes 21 revolutions a minute and raises one arm of the bellows which handles about 2 liters of air at a time. No valves are employed. A garden hose is used, and at the point where the hose is connected with the cannula is a vent opening to the outside air. As the air is expressed from the bellows, part of it goes into the dog's lungs and part out of the bent. As the bellows open air is withdrawn from the lungs. This means, of course, that a portion of air is rebreathed. But another portion of fresh air comes in by the vent. This mixture is sufficient to preserve life satisfactorily. The open vent also prevents overdistention of the lungs by too much pressure.

Neurosurgery with cortical localization and various other procedures on the central nervous system may be practiced. There is unlimited opportunity for practice in the suturing of nerves and tendons, and the present day development of blood vessel surgery is in a large measure due to experience obtained on the dog.

An eye, ear, nose, and throat man who has interested himself in this work has found that the dog affords good practice work in esophagoscopy and bronchoscopy. The length of the dog's head is such that various instruments may not be long enough to work through the mouth and in such a case he approaches the bronchial tree by tracheotomy. This is occasionally necessary in man. The larynx may be used for laryngofissure.

The structures of the eye appear to be too thick and tough to be of much practical value to the eye surgeon. The ear has not been used in our work.

We do not own a peritoneoscope set. However, we practiced with a direct vision cystoscope introduced through a 1 cm. incision into the dog's peritoneal cavity. With the familiarity thus obtained we have been able to use it with a better degree of understanding in selected human cases.

One of our urologic friends practices manual dexterity in the handling of the resectoscope by using the dog's esophagus.

We feel that our experience with the various types of suture material and needles has been worth while. We are indebted to Davis and Geck, Armour, Curity, Johnson and Johnson, and Scalan for their kindness in furnishing samples of catgut of all sizes, including ooooo. Most of the work, however, is done with linen and silk thread of various sizes, always using the lightest thread and finest needles adaptable for the work in hand.

The development of facility in the handling of instruments, suture material, and tissues has been important to us. Also, in view of the fact that the young man in a small town operates infrequently, the major contribution to our experience has been practice gained in the more common surgical skills.

Only animals which are in the pound and which are to be exterminated anyway are used. The dog is handled and anesthetized in a manner which is much more humane than that employed in the dog pounds. There can be no sane criticism, providing the animal is in no way permitted to suffer pain. At the close of the operation the dog is killed by any of several humane means.

This form of training has been employed for many years in the teaching centers. We venture to suggest that it can make an even greater contribution to the self development of the practicing surgeon who does not have access to these centers.

Clyde O. Merideth, Jr., M.D.
Thomas Peck Butcher, M.D.

ORIGINAL ARTICLES

THE CHANGING CONCEPTION OF CANCER OF THE PROSTATE

ROBERT GUTIERREZ, M.D., F.A.C.S.

NEW YORK CITY

FROM the very dawn of medical history, the prostate gland has been recognized as a source of misery to the male in the declining years of life. Notwithstanding the great progress that the ages have witnessed in the healing art, the prostate continues to hypertrophy as old age comes on. And side by side with benign hypertrophy, and indistinguishable from it in its early stages, there has stalked the specter of malignant disease of this organ, constituting one of the major problems among diseases of the genitourinary system. By the time symptoms of dysuria and retention have appeared, the cancer has as a rule metastasized, causing the prognosis to be, at best, a gloomy one. Not only was a fatal outcome to be looked for, but the patient's last days were made wretched with the discomfort of the inevitable suprapubic cystostomy in order to accomplish artificial drainage of the bladder.

The purpose of this paper is to call attention to a new attitude toward cancer of the prostate, which emphasizes the possibilities of immediate relief of symptoms without major surgery, as soon as there are signs of retention; and to point out, with a view to this end, the importance to every man 50 years of age or over of having a rectal examination of the prostate once a year as a matter of routine. The layman has little conception of the silent beginnings of malignancy that may be discoverable by the examining finger long before any urinary symptoms appear. Should the presence of a nodule, however small, be discovered, a biopsy specimen should immediately be obtained to determine the nature of the induration.

Should symptoms already have arisen, modern surgery offers the sufferer the possibility of complete relief through transurethral prostatic resection, a procedure which enables him to live in comparative comfort and which also tends to prolong his life by relieving back pressure upon the upper urinary tract. He will be enabled to pass urine without discomfort, and, should the same symptoms of dysuria occur, a second, or a third resection can again be carried out, according to his needs, thus making it possible for him to live out the days remaining to him without the burden of wearing a permanent suprapubic drainage apparatus with all that this implies.

INCIDENCE OF CARCINOMA OF THE PROSTATE

The frequency with which carcinoma of the prostate may be present in cases superficially appearing as benign hypertrophy was first mentioned by Albarran and Hallé[1] who, in the course of a study of one hundred specimens of prostatic hypertrophy in the Musée Guyon of the Necker Hospital, discovered malignancy in fourteen cases, or approximately 7 per cent. This led Young,[2] in 1905, to check up his own cases and to verify by exact figures the impression he already had that carcinoma of the prostate was more frequent than had been recognized. To his amazement, and that of urologists in general, he found in his clinical and pathologic material no less than 21 per cent of carcinoma among his cases of prostatic

obstruction. From Young we obtain also the following percentages as furnished by other writers: Oliver Smith, 16 per cent; Pauchet, 20 per cent; Davis, 20 per cent; Moullin, 25 per cent; Kuemmel, 20 per cent; Wilson and McGrath, 15.5 per cent; Freyer, 13.4 per cent; Institute of Pathology in Munich, 21 per cent.

Two recent reports, from Rich[3] and Moore,[4] working independently, confirm these figures. Rich of Johns Hopkins Hospital wrote, in 1935, that in 292 consecutive autopsies of male prostatics, forty-one proved to be cases of carcinoma (14 per cent). In two-thirds of these, the growth was too small to be recognized clinically. In eighty-two cases from the urologic service, seventeen (21 per cent) proved to be cancer. Moore, in the same year, after carrying out studies in two hospitals in Vienna, reported that he found in 375 prostatics sixty-three cases (16.7 per cent) of cancer of the prostate. Of these, fifty-two were occult and eleven manifest.

Myers[5] (1937) found a still larger percentage of carcinoma. Of seventy-five cases of prostatic obstruction examined in the Pueblo Clinic twenty-two proved to be malignant (29.4 per cent), while fifty-three (70.6 per cent) were benign hypertrophies.

Hoffman,[6] of the Prudential Insurance Company, discussing the figures of the United States Census Office with reference to the death rate per 100,000 male population from cancer of the prostate, states that deaths from this cause increased from 3.6 per cent in 1920 to 8 per cent in 1931, with a total of deaths from carcinoma of the prostate amounting to 38,486 in the twelve-year period.

Studies of the age groups in which cancer of this organ is liable to be found show the greatest number of cases in the sixth, seventh and eighth decades. Thus Moore[4] in his study of fifty-two occult cases, found none in patients under 40, but observed four cases in the fifth decade (41–50), six in the sixth, eighteen in the seventh, thirteen in the eighth, and seven in the ninth. In terms of percentage, Rich[3] observed in his 292 patients that 11 per cent showed cancer between the ages of 55 and 60, 21 per cent between 66 and 70, 28 per cent between 71 and 75, 37 per cent between 76 and 80, and 20 per cent between 81 and 90. Caulk and Boon-Itt[7] report that 93.9 per cent of their patients were over 50, and about 90 per cent were in the sixth, seventh and eighth decades. Bugbee[8] has operated on cancer of the prostate in patients from 45 to 97 years of age. Thompson and Emmett[9] found most cancers between 60 and 69, and the next between 70 and 79. The average age with Bumpus[10] was 65, and the average duration, in an untreated case, was thirty-one months.

Hager and Hoffman[11] (1937) reported that in their series of 396 cases, covering thirteen years, more than one-half had had symptoms for less than a year, and 50 per cent for less than six months.

Barringer[12] stated that in 98 per cent of his cases, when seen, the carcinoma had grown beyond the prostate. Graves and Militzer,[13] reviewing eighty-one cases of cancer with metastases, found that in all but six metastases to the bone were present. The total duration, where this was known, was from one to five years. Forty-three patients (53 per cent) survived less than nine months after demonstration of metastases.

Moore[4] found that metastasis and invasion outside the organ are a late manifestation, but that there is early invasion of the perineural lymphatics within the prostate. Dossot[14] emphasized the frequency with which the cancer invades the sacrolumbo-abdominal lymph nodes. Among thirty-six autopsies of cases of prostatic cancer he found that in thirty-four there had been invasion of the iliopelvic lymph nodes, and in thirty-three, of the abdominal lymph nodes.

Bumpus[10] demonstrated metastases in 243 of 1000 cases at the Mayo Clinic. Where these were present, he too had an average survival of nine months. There

were only twenty-one five-year cures among 164 patients submitted to prostatectomy (forty-seven perineal, 117 suprapubic).

EARLY RECOGNITION IMPORTANT

We see, therefore, that carcinoma of the prostate is a widespread condition, and that unless it is clinically recognized before it has metastasized the patient is already beyond any but palliative treatment. If, on the other hand, the first small signs of a nodule are discovered and recognized by digital examination of the rectum, there is still room for hope that perineal prostatectomy may accomplish arrest of the process. If the disease is not already too extensive, a radical cure can be obtained. Young[2] states that his statistics show cures in over 50 per cent of cases in which the prognosis was at all favorable. G. G. Smith[15] after radical operation on fifty early cases, reported that seventeen (33 per cent) were alive and well one to eight years after operation. A substantial number of five-year cures of early cases have also been reported by Marion,[16] Yllyes,[17] Wildbolz,[18] and others. According to Caulk,[19] however, prostatectomy is applicable in only 3 to 5 per cent of any surgeon's cases, and he would hesitate to propose it because of the difficulties of being sure that the disease was confined to the gland. "The majority of operators," says Caulk, "have as their hope, of course, to cure the disease, but actually they strive at the postponement of death and alleviation of the symptoms."

For this reason, it cannot be too strongly emphasized that men over 50 should be warned of the possibility of a silent carcinoma of the prostate, and instructed as to the importance of routine examinations once a year to discover the actual conditions of this organ, so that, if the least sign of a carcinoma exists, the beginning growth in the prostate may be removed while it is still operable. If such an examination should reveal the presence of cancer, the earlier this is known the better will be the prognosis. The great majority of patients today wait until urinary symptoms appear and until they are beyond the stage in which a radical procedure can be carried out. For such individuals, however, it is unquestionable that transurethral resection, when properly done, prolongs life and gives great relief without extensive surgery.[20]

In cases so far advanced that toxemia and uremia have already resulted from obstruction, it is startling to see how much may even yet be accomplished by this modern means of securing drainage. Many of these cases respond almost miraculously and can be restored to a fair degree of health and usefulness even though the cancer has metastasized. Although these patients will ultimately die of cancer, they escape the torment of intolerable urinary symptoms and have the prospect of succumbing to a metastasis with far less pain than that which attends the late stages of cancer of the prostate.

After removal of the carcinomatous obstruction by transurethral resection, it is still possible to control pain and prolong life by use of *x*-rays or radium treatment. Indeed, as a means of relieving pain the value of these radiologic methods in selected cases and in suitable dosage is beyond question when cure is no longer a possibility.

This modern transurethral procedure, or closed method of approach, when carried out in competent hands, not only relieves symptoms but also avoids the common complications that are encountered when the open method of surgery is used for advanced cases. In fact, bothersome perineal fistulas, both urinary and fecal, as well as urinary incontinence, are entirely eliminated by the transurethral method. In addition this procedure obviates the long suffering and annoyance following a suprapubic cystostomy, with its burdensome sequel of a catheter life.

In my own clinical experience with carcinoma of the prostate I have observed

that patients operated upon by this conservative method live longer, have less urinary distress, less reaction and inconvenience, and, on the whole, are much more comfortable, besides being saved the disadvantages of a long stay in the hospital for radical treatment of a condition which is already hopeless.

CLINICAL CONSIDERATIONS

With regard to operability, three clinical types of cases may be recognized. We may group these as follows:

Group I. Silent or occult cases (operable).

Group II. Circumscribed cases, with the malignant growth still confined within the capsule (still operable).

Group III. Diffuse cases of carcinosis (inoperable).

The existence of a cancer in any of these groups can be discovered in most cases by rectal examination. Digital palpation within the rectum will discover the form, shape and consistency of the prostate, and will reveal any nodulation or irregularity of the surface of the gland. In the hands of one who has been properly trained for it, this examination will, in most instances, suffice for a diagnosis of carcinoma of the prostate. Cancers even as small as half the size of a pea have been revealed by this procedure. To one who is accustomed to this type of examination, the finding of such a nodule is easily recognizable as suggestive of cancer. The diagnosis can be verified by needle biopsy, which in about 70 per cent of cases will yield a positive finding.

But it is obvious that if a carcinoma is to be discovered in time for a cure, it will be brought to light ordinarily only in the course of a general physical examination, for at the outset there are no urinary symptoms to bring the patient to a urologist. Such an examination will, therefore, in the nature of things be conducted by a general practitioner. Too often this general physical examination does not include, as it should in all men over 50, an examination of the prostate gland. It is of great importance, accordingly, that every student in every medical school be taught to make this examination and to interpret its results. In the future we may expect that no student will be allowed to engage in medical practice who has not acquired proficiency in the technique of rectal palpation of the prostate, and the interpretation of the findings.

Group I. Silent or Occult Cases. In this group the patient has no symptoms of any kind relating to the prostate or the urinary system, nor is there anything in the history to suggest metastases. He is being examined solely as a routine procedure, as a precautionary measure for his own protection against possible future trouble. It is unfortunate that the individuals composing this group do not, as a rule, develop urinary symptoms until late. Urinary manifestations which might attract attention to the existence of a carcinoma are usually much slower to appear than in a case of benign prostatic hypertrophy.

It is estimated that about 10 per cent of cases can be diagnosed rectally early enough to permit cure of the cancer by a radical perineal prostatectomy. Since the posterior lobe of the prostate is the site of predilection for carcinoma, being the primary seat in about 80 per cent of cases, whereas benign hypertrophy begins more frequently in the median or lateral lobes, we have at once a clue to the probable significance of any marked induration in the posterior lobe that may be felt by the examining finger, especially if such hardness is in the form of a nodule or an irregular surface of stony-hard consistency. (Fig. 1A.) Palpation of such a nodule upon a sound or on the cystoscope renders its differentiation from a calculus easier. If such a nodule is felt, and there is any room for doubt, needle biopsy may clear up the diagnosis.

In any event, upon discovery of a nodule, urethrocystograms should immediately be taken, as well as plain roentgenograms to reveal whether stone, local

CANCER OF PROSTATE

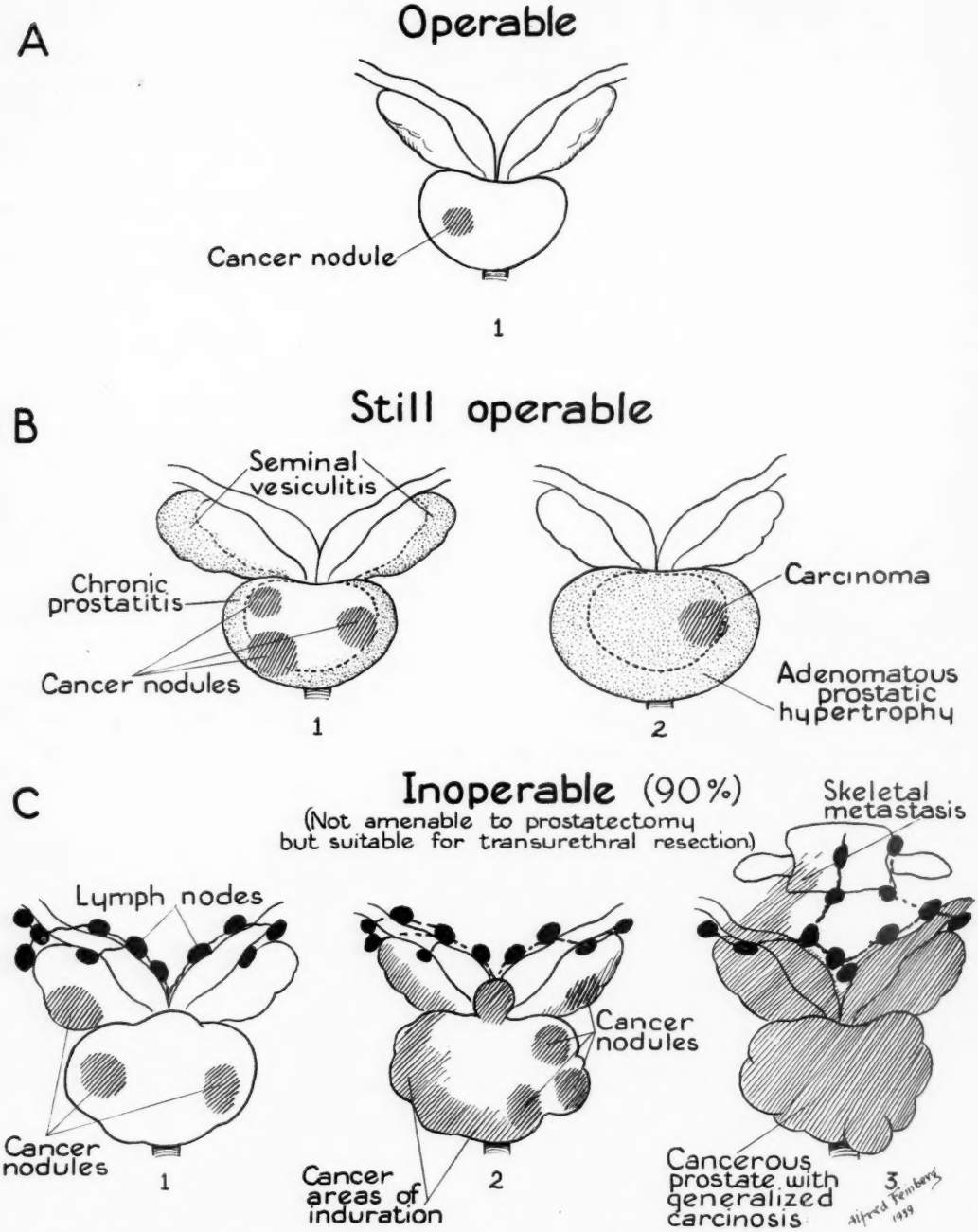


FIG. 1. Schematic representation of the three clinical groups of cancer of the prostate most commonly observed, from the point of view of operability and cure. A, silent or occult group without symptoms, in which the minute cancer nodule can be detected by rectal palpation and in which total prostatectomy will accomplish cure. B, circumscribed group, in which the cancerous lesions have not extended beyond the capsule but in which urinary symptoms have appeared. 1, the fibrous type of prostate with evidence of chronic prostatitis and seminal vesiculitis in which the presence of stony hard nodules reveals the concomitant cancerous lesion. 2, the adenomatous type of prostatic hypertrophy associated with carcinoma. In both of these types the malignant lesion is circumscribed and is still amenable to prostatectomy. C, the diffuse group, in which generalized carcinosis has arrived, with a fixed gland and clinical evidence of metastasis, indicating that the malignant growth has spread beyond the capsule and is already inoperable. 1, the growth has invaded the seminal vesicles and lymph nodes of the prostatovesicular space. 2, the cancerous area of induration within the gland has expanded, with multiple nodular infiltrations and invasion of the periprostatic structures. 3, the late stage of generalized carcinosis is shown, with multiple skeletal metastases, advanced encroachment upon the prostatomembranous urethra, and invasion of the bladder neck and surrounding structures. Cases in Group C, which unfortunately comprises 90 per cent of cases seen by the urologist, can be relieved of their urinary sufferings, and their life span materially prolonged by the modern method of transurethral resection. (See text, Clinical Considerations.)

extensions, or bony metastases are present. The urethrocystogram will reveal whether any changes have occurred in the outline of the prostatic urethra, the vesical orifice or bladder. Routine *x*-ray studies will show whether there are metastases in the bony pelvis, the sacrum, the ilium, the lumbar vertebrae or chest, these being as a rule the first skeletal structures to be invaded. They will also differentiate a possible calculus. One should remember, however, that it is possible for a calculus and a cancerous nodule both to be present. If stone can be excluded, the hard, irregular, nodular prostate is easily recognizable as carcinomatous. In this case, further digital examination of the rectum will reveal whether the growth has invaded the seminal vesicles, which are in 50 per cent of cases the next tissue to be involved. If these are found to be of normal consistency, and the *x*-ray examinations are negative for metastases, it can be safely assumed that the growth is still confined within the capsule of the prostate itself. It is, therefore, amenable to early removal by means of a radical prostatectomy.

In the autopsy findings of Mintz and Smith[21] upon 100 cases of cancer of the prostate, only thirteen cases could be regarded as of this early type. These thirteen patients had died of unrelated diseases, while the malignant growths still remained occult and without evidence of metastases.

Group II. Circumscribed Cases. In this group, urinary symptoms have appeared, for which the patient seeks relief at the hands of a physician. There is frequency of urination day and night and some dysuria, and anything from a slight amount of residual urine to complete retention. But examination reveals that the prostate is elastic in consistency and is still freely movable from side to side, showing that the lesion is still circumscribed to the gland and has not extended beyond the limits of the capsule. There may, however, be one, two or three stony hard nodules involving the posterior lobe, or the right or left lateral lobes, but no evidence to the palpating finger of involvement of the seminal vesicles, ampullae or intervesicular space, and no adhesions to the rectal wall, although there may be evidence of chronic prostatitis and seminal vesiculitis. (Fig. 1B—1.) In some of these cases the cancer grows very slowly, especially where fibrous tissue predominates. Denonvilliers' fascia for a long time proves an adequate protection against extension toward the rectum.

A prostate gland removed with a diagnosis of simple hypertrophy frequently contains nodules of malignant degeneration (about 13 per cent). In cases where carcinoma and benign adenomatous hypertrophy exist at the same time within a prostate, the patient is likely to visit his physician earlier, since as a rule the benign hypertrophy causes urinary distress and frequency earlier than does the cancerous nodule, which is usually in the posterior lobe where it does not encroach upon the urethra and bladder neck. Many of these cases, therefore, may be discovered at an earlier stage than those of group 1, which is a factor greatly in their favor, from the point of view of prognosis. (Fig. 1B—2.) Pasteau[22] holds that the surgeon who makes it a practice to remove a prostate gland for simple hypertrophy is, in effect, controlling cancer of the prostate gland. When such a carcinoma comes under observation, while the prostate is *still movable*, and the adjacent structures have not been invaded, that is to say, while it is still confined within the capsule, it is amenable to removal by a total radical prostatectomy. Cases in which this procedure has been carried out at this stage have been reported by various authors; there has been no recurrence, and the patients could be pronounced cured, having lived for many years afterward in excellent health. Hence, if we can get hold of these cases while the malignant growth is still limited within the capsule, and while the gland is still freely movable beneath the finger, with no adhesions to the surrounding tissues, we can with

every confidence look forward to complete cure, by an operation no more perilous than that which is done every day for benign prostatic hypertrophy. In all cases where the prostate can be enucleated entire, there is no reason to hesitate to do the total operation. Carefully selected cases in groups I and II successfully cured by radical prostatectomy, surviving for long years afterward without recurrence and free from urinary troubles of any kind, have been reported by Young,[2] Freyer,[23] Hinman,[24] Marion,[16] Wildbolz,[18] Yllyes,[17] Rolnick,[25] G. G. Smith[15] and others.

Total perineal prostatectomy involves removal of not only the prostate, but also of the seminal vesicles and ampullae, the bladder neck, and most of the fascia about the prostate. All the structures between the ureteral orifices and the membranous urethra are resected, after which the bladder neck is united to the membranous urethra. The external sphincter is not disturbed, and the patient preserves his continence.

Radical suprapubic prostatectomy implies the removal of the prostate and its capsule with the bladder neck, the seminal vesicles and their ampullae all in one piece through the bladder as described by Marion[16] and also by Pauchet.[26]

In carefully selected cases one or the other of these radical operations should be chosen, when the surgeon is convinced that the malignant growth is still circumscribed to the prostate. In this group simple enucleation is not enough, for in most cases it causes spread of the cancer, many instances having been observed in which the carcinoma has invaded the remaining capsule and has extended into the bladder neck and trigone. Some of these prostatic carcinomas are of extreme malignancy, and metastasize very early. The safest course, therefore, if the growth has not yet penetrated the capsule, is to perform the radical perineal operation, in which the immediate operative mortality is less and the patients appear to live longer than when the suprapubic operation is done. When this is carried out under proper indications and by the improved methods of the most modern technique, the results are very encouraging.[20]

Nevertheless, in *borderline* cases, in which there is evidence of adenomatous hypertrophy with an induration or a nodule somewhat suggestive of carcinoma but no evidence of metastasis or extension, most urologists are in accord that a simple early enucleation is sufficient and that this is the best operative choice under the circumstances. In the event then that the histologic examination of the specimen removed at operation reveals malignancy, the patients of groups I and II should receive, as a prophylactic measure, a routine postoperative course of deep *x*-ray treatments, preferably repeated every six months, and designed, if not to effect a cure or to check the spread of the disease, at least to control and mitigate the painful symptoms which will ultimately develop. Some urologists instead use implantation of radon seeds or a combination of these with *x*-rays. The use of *x*-rays without radon seeds, however, seems to be less irritating and more soothing as a means of relieving pain and urinary distress.

Group III. Diffuse Cases. Carcinosis. In 90 per cent of the cases that are seen, the carcinoma has already spread beyond the capsule and cannot be removed. The gland, of stony hardness, has become fixed and immovable. Rectal examination now reveals in addition an increased resistance in the intervesicular space just above the prostate. This results in an elevation of the subtrigonal plateau, easily recognized in the cystoscopic examination. The interlobular sulcus in the prostate itself is found obliterated, and the circumference of the gland is irregular and somewhat nodular. The seminal vesicles are distended and sometimes full of nodular infiltrations, revealing the extension of the disease.

Urinary disturbances have become very troublesome in most of these advanced cases as the result of obstruction to the outflow of the urine, although in many the

gland may be actually small or atrophic. In Caulk's series 35 per cent were of this type; but they were much more virulent and metastasized much more quickly than those of large size. Notwithstanding the smallness of the primary growth in such cases, metastases are present at a very early stage in the disseminating type. (Fig. 1C, 1, 2, 3.) In many of these cases the patient is suffering from arthritis, sciatic pain or lumbago, and a plain roentgenogram discloses that these symptoms are due to multiple bony metastases. In other cases, of scirrhous type, the cancer may give rise to little or no inconvenience of any kind. The patient is unaware of his danger, and the case does not reach the surgeon until all hope of eradication of the growth is past.

In no other type of carcinoma is it so tragically true as in that of the prostate that by the time it is diagnosed clinically it is already too late to operate or to give any but symptomatic treatment. In all these cases generalized metastasis has taken place into the lymphatics and their lymph nodes, involving the skeletal system, the bronchopulmonary and mediastinal regions and other internal organs. There is direct extension into the bladder, ureters, and, more rarely, into the membranous urethra, the corpora cavernosa, glans penis, perineum and rectum. But as a rule the seminal vesicles and the lymphatics of the prostate and the intervesicular space are the first tissues to be invaded. Not only frequency and painful urination, with marked nocturnal dysuria, but also hematuria, bladder tenesmus, incontinence and complete retention with pain in the rectum and perineum are among the cardinal symptoms observed in these late cases. In addition the back pressure due to the retention results in ascending infection, with marked dilatation of the ureters and pyelonephritis, leading finally to pyoureters, pyonephrosis and a terminal picture of uremia and cardiorenal failure.

TRANSURETHRAL RESECTION

When a cancer has reached this third stage and has cleared the capsule, only palliative treatment is applicable. But no longer are we compelled to have recourse to suprapubic drainage and the wearing of a permanent catheter, which until recently constituted the only "palliative" available for symptoms of urinary obstruction, after these had become established. When Young in 1909 announced his "punch" operation for endoscopic removal of bladder neck obstructions, followed in 1910 by Edwin Beer's successful application of the high frequency current to tumors of the bladder by way of the cystoscope, the full significance of these innovations in urosurgical technique was little realized. It took years for the technique to be perfected and years for the requisite experience in its handling to be acquired, before its full value and its relative safety could be recognized. Today, in the hands of an expert, the mortality rate from this procedure is less than 2 per cent.

Only within the last seven years has the use of this method become sufficiently general for its applicability in cases of hopeless, incurable cancer of the prostate to be appreciated. It has enabled these patients to be relieved completely of their urinary sufferings and to live a normal life for at least months, and not infrequently for years, while the carcinoma has pursued its inexorable march. The procedure has overcome back pressure upon the upper urinary tract, and caused the menace of residual urine to be abolished. Some who have come even in a state of pronounced toxemia have been restored to improved vitality and have lived a life of relative comfort for varying periods. Of 129 cancer patients upon whom Caulk[19] operated with the cautery punch, 30 per cent were living after three years, 18 per cent after four years, 12 per cent after five years, and 5 per cent after seven or more years.

It has been objected by some surgeons, especially of the French school, that by deliberately cutting through the tissues

of a malignant growth one of the most elementary principles of surgery is violated. A cancer should either be removed in toto, or not touched with the knife at all. Thus we find Chevassu[27] saying that a transurethral resection is like the lash of a whip to the growth of a prostatic cancer. Experience, however, does not show this to be the case. All urologists who have used this method extensively will be inclined to agree with Jacobs'[28] statement that with a patient in whom the prognosis is inevitably going to be downhill, this consideration need be no deterrent to a procedure which aims at relieving the urinary obstruction and not at a curative effect. When it has become evident that the cure of a sufferer is out of the question, the first concern of the surgeon should be to relieve pain rather than to prolong, for a brief span, a life that has become, at best, a burden without such relief.

In carrying out a transurethral resection, it has been found that carcinomatous tissue is trimmed away with more ease than benign hypertrophied tissue and that as a rule there is less hemorrhage. Few bleeding points have to be coagulated during operation. Carcinoma of peripheral type with growth at the neck of the bladder lends itself better to resection than that which has invaded the prostatic urethra, where resection may be technically more difficult. This procedure is especially indicated in cancers of slow growth. The presence of metastases is not to be regarded as a contraindication. No good reason can be adduced for failure to relieve urinary symptoms that are causing distress, while the carcinoma is progressing in some other part of the organism.

Transurethral resection may thus be regarded as a means of enabling the patient to utilize to the best advantage the time left to him by the cancer, which may be shorter or longer, but which apparently is not affected adversely in its duration by this beneficient palliative operation. He will be able to escape the bondage entailed by a suprapubic fistula and a permanent catheter life, and to live with his family in comparative comfort, a burden neither to himself nor to others. And in not a few such cases, death has been the result of an intercurrent disease, and not of carcinoma. Again, in cases where there has been extensive metastasis, death often comes as the result of this process instead of from the primary carcinoma, with its many agonizing features. It may come from metastatic processes, the pain of which it is much easier to control, by suitable measures, than the intolerable suffering of the man dying from cancer of the prostate, with its imperious urgency and dysuria. In cases where the prostatopelvic carcinosis is so extensive that it is producing great distress and is causing intolerable radiating or localized pain, it is possible to bring symptomatic relief of these manifestations by the routine use of deep *x*-ray treatment. In addition to this method of radiation for the relief of pain, some authors advocate the implantation of radon seeds or radium needles with a view to controlling the disease by reducing the size of the gland; but this type of radiation as a rule has not only been painful, but has also caused many complications, and the results up to the present time have on the whole been disappointing.

Although no one method of treatment has been entirely satisfactory in this group, it appears that the best choice of treatment in our present state of knowledge is transurethral resection to relieve obstruction, followed by courses of deep *x*-ray treatments, to control the dissemination of the disease and to minimize the painful symptoms arising from the original lesion and its metastases.

It is not to be denied, however, that there are advanced cases, in which the prostate has become so fixed and the caliber of the urethra so narrow that neither a sound nor the small resectoscope can be passed. In such cases a permanent cystostomy is, of course, still in order as the best means of relieving back pressure and urinary distress. But when the cancer-

ous lesion has extended up into the bladder and ureters, even cystostomy may fail to give relief and the only possible recourse is to divert the urine by bilateral transplantation of the ureters. It may be said, however, that in well chosen early cases of groups I and II when the biopsy reveals that the gradation of the malignancy is still of type 1 or 2, or histologic examination of the specimen removed by transurethral resection shows an early type of malignancy, the radical perineal prostatectomy should be offered to the patient as the best opportunity to attain permanent cure. But when the biopsy reveals that the malignant lesion is already of type 3 or 4, it is too late to contemplate a permanent cure by a total prostatectomy. Also in those late cases of group III that histologically belong to type 3 and 4, when the malignancy has already metastasized and the prognosis is hopeless, the procedure of choice should be the palliative method of transurethral resection for relief of the obstruction and the urinary distress.

It is important that all fragments of tissue removed for the purpose of biopsy be properly examined. Material removed by transurethral resection should all be saved, since in a large number of cases the diagnosis can be verified by its examination. For this purpose I[20] have devised a "fishing net" to be attached to the resectoscope to facilitate the collection of all prostatic material resected, since this will frequently be the key to the diagnosis.

SUMMARY

The toll of cancer of the prostate in men over 50 years of age is so great as to constitute one of the major problems in urology. Until quite recently urologists have adopted a defeatist attitude, and have assumed that cases no longer amenable to prostatectomy (which meant the great majority) must face the inevitability of a suprapubic cystostomy, with all the sufferings entailed by a catheter life, in order to relieve urinary symptoms. The life thus prolonged for a few months or years had little attraction for its victims or their households.

Within recent years, however, a new attitude has arisen toward malignant diseases of the prostate, which emphasizes the possibility of immediate relief of urinary symptoms in hopeless cases, without the use of major surgical procedures. In such cases, as soon as the encroachment of the malignant growth upon the bladder neck and urethra begins to cause symptoms of dysuria and retention, the urologist may now relieve these symptoms by transurethral resection of the offending portion of the prostate, a procedure of great simplicity in the hands of one experienced in its execution. Should the same symptoms develop again later on, the same procedure is again available, as often as seems necessary.

However, with the means of early diagnosis that are now available, there is no necessity for the great number of deaths from cancer of the prostate that have been observed up to the present time. These have been due largely to the silent manner in which these carcinomas usually develop. The early beginnings can now be discovered and recognized by any physician who has been trained to make routine examinations of the prostate by way of the rectum. Long before any urinary or other symptoms appear, the examining finger may discover the presence of a stony hard nodule in the posterior lobe of the prostate, in men over 50 years of age.

Men who have reached this critical age should, accordingly, as a prophylactic measure have routine examinations of the prostate once a year, so that if the least sign of such a nodule is discovered, the growth may be totally removed before it becomes inoperable. Since these patients have no urinary symptoms to bring them to the urologist, it is important that every general practitioner learn the technique of such an examination, and emphasize its importance to all elderly men who come for a general physical examination.

When such a nodule is found, a needle biopsy should immediately be done to confirm or refute the suspicion of carcinoma. If the biopsy findings are positive, and the *x*-rays show no metastasis, perineal prostatectomy at this early stage will in most cases accomplish complete cure.

Cancer of the prostate may, according to its stage and treatment, be divided into three groups:

Group I consists of silent or occult cases, with no symptoms. These are amenable to prostatectomy.

Group II consists of cases which are circumscribed, still confined within the capsule of the prostate, but in which urinary symptoms have appeared. So long as the gland is freely movable, it is evident that the adjacent structures have not been invaded, and the growth is still amenable to a total radical prostatectomy.

Group III consists of cases in which the carcinoma has spread beyond the capsule, and cannot be removed. Of the cases seen, 90 per cent fall within this group at the present time. Metastasis has occurred into the lymphatic and osseous systems, and besides urinary symptoms the patient is usually suffering with arthritis, sciatic pains, lumbago, or other type of pain due to perineural invasion or invasion of the skeletal system. In addition to local symptoms and the presence of a general induration of the entire region surrounding the prostate, the patient is affected with a generalized carcinosis. Prostatectomy is no longer available. These cases lend themselves, however, to transurethral resection for relief of urinary distress.

The purpose of this paper is, first, by urging early examination, to bring into group I and II many of the cases that would otherwise reach the condition of group III, cases that reach the surgeon too late for eradication of the growth; and secondly, to emphasize the ease with which those who are so unfortunate as to have reached the status of group III, may still have their urinary symptoms relieved or even wholly abated, and their lives materially prolonged in comfort, by undergoing transurethral prostatic resection.

The objection traditionally raised against incision of a malignant growth, that it may give rise to metastases, has no weight here, since there is admittedly no hope of cure in these group III cases. The patient is already full of metastases, so that their avoidance is no longer a consideration. The main object of the surgeon should now be to relieve symptoms as they arise, and especially to obviate the sufferings of a catheter life such as these patients have in the past been compelled to lead. The use of *x*-rays for relief of pain and to control metastasis is also recommended.

About 5 per cent of group III will not be amenable to transurethral treatment, owing to the impossibility of passing any kind of instrument into the urethral canal upon which the carcinoma has encroached. For these patients, suprapubic drainage, or, as an alternative, possible transplantation of the ureters, must still remain the only means of relief.

CONCLUSIONS

1. Carcinoma of the prostate is more common than is suspected; in fact, it is three times as frequent as cancer in any other internal organ of the male.

2. Carcinoma of the prostate is now known to be present in about 20 per cent of all cases of prostatic obstruction.

3. All men over 50 years of age should be subjected to routine rectal examinations, with a view both to discovering the possible existence of a cancer nodule in the prostate, and to preventing its further development.

4. Three groups of cases are presented from the point of view of operability and cure.

5. In early cases cure can be obtained by total perineal prostatectomy.

6. Advanced cases with evidence of metastasis, which unfortunately constitute about 90 per cent of all cases at the present time, are not amenable to radical operation or cure.

7. These inoperable cases can now, however, be relieved of their painful symptoms and urinary obstruction by the modern procedure of transurethral resection.

8. Transurethral resection should be carried out only by a competent urologist, experienced in this new method of treatment.

9. Transurethral resection should never be considered for an early case, which is amenable to cure by radical operation.

10. After operation, the patient should receive deep *x*-ray treatments to control metastases and to relieve pain and urinary distress.

11. More cases of carcinoma of the prostate could have been cured if the diagnosis had been made "early" enough to let the specialist-surgeon carry out a conservative radical perineal prostatectomy.

12. The prognosis for a five-year cure is greatly improved under this new conception of the management of carcinoma of the prostate.

REFERENCES

1. Albarran and Hallé. Hypertrophie et néoplasies épithéliales de la prostate. *Ann. d. mal. d. org. gén. urin.*, p. 113, 1900.
   Albarran, J. Tumeurs malignes de la prostate. In: Traité de chirurgie clinique et opératoire, 9: 680–714, Paris, 1900. Le Dentu et Delbet.
   Albarran, J. Médecine opératoire des voies urinaires. Prostate. Paris, 1909. Masson.
2. Young, H. H. The radical cure of cancer of the prostate. *Surg., Gynec. & Obst.*, 64: 472–484, 1937.
   Young, H. H. Cancer of the Prostate. In: Cabot's Modern Urology, Chapt. 19. Philadelphia, 1936. Lea & Febiger.
   Young, H. H. The ultimate results in the treatment of carcinoma of the prostate by the radical removal of the prostate, vesical neck and seminal vesicles. *J. Urol.*, 29: 531–543, 1933.
3. Rich, A. R. On the frequency of occurrence of occult carcinoma of the prostate. *J. Urol.*, 33: 215–223, 1935.
4. Moore, R. A. The morphology of small prostatic carcinoma. *J. Urol.*, 33: 224–234, 1935.
5. Myers, G. M. The occurrence of carcinoma in clinically benign prostatic obstructions. *Colorado Med.*, 34: 248–251, 1937.
6. Hoffman, F. L. Cancer of the prostate and prostatic diseases. *New England J. Med.*, 210: 507–512, 1934.
7. Caulk, J. R., and Boon-Itt. Carcinoma of prostate. *Am. J. Cancer*, 16: 1024–1052, 1932.
8. Bugbee, H. G. Cancer of the prostate. *Tr. A. A. Genitourin. Surgeons*, 29: 207–212, 1936.
9. Thompson, G. J., and Emmett, J. L. Treatment of carcinoma of the prostate gland by transurethral methods. *Urol. & Cutan. Rev.*, 39: 679–685, 1935.
10. Bumpus, H. C. Carcinoma of the prostate. A clinical study of 1000 cases. *Surg., Gynec. & Obst.*, 43: 150, 1926.
11. Hager, B. H., and Hoffman, E. F. Statistical data on 395 cases of carcinoma of the prostate. *J. Urol.*, 37: 180–185, 1937.
12. Barringer, B. S. Phases of the pathology, diagnosis and treatment of carcinoma of the prostate. *J. Urol.*, 20: 407–411, 1928.
13. Graves, R. C., and Militzer, R. E. Carcinoma of prostate with metastases. *J. Urol.*, 33: 235–251, 1935.
14. Dossot, R. Les origines et les extensions du cancer de la prostate. *Arch. urol. de la clin. de Necker*, 5: 257–311, 1927.
15. Smith, G. G. Total perineal prostatectomy for carcinoma. *J. Urol.*, 35: 610–617, 1936.
16. Marion, G. À propos du traitement du cancer de la prostate. *J. d'urol.*, 21: 385–396, 1926.
17. Yllyes, G. v. Erfahrungsergebnisse bei Nieren,-Blasen-und Prostatakrebs. *Ztschr. f. urol. Chir.*, 41: 123–132, 1935.
18. Wildbolz, H. Die Erfolge operativer Therapie des Prostatacarcinoms. *Schweiz. med. Wchnschr.*, 29: 726, 1928.
19. Caulk, J. R. Carcinoma of the prostate. *J. Urol.*, 37: 832–839, 1937.
20. Gutierrez, R. Transurethral treatment of bladder neck obstructions: Endoscopic prostatic resection. In: History of Urology, chapt. 5, 2: 137–186. Baltimore, 1933. Williams and Wilkins.
    Gutierrez, R. Later results of surgery of the seminal vesicles. Report of one hundred consecutive seminal vesiculectomies. *J. A. M. A.*, 93: 1944–1951, 1929.
    Gutierrez, R. Surgery of the seminal vesicles, ampullae and vasa deferentia. In: Oxford Loose-Leaf-Surgery. Chapt. 9, 3: 300–509. New York, 1935. Oxford University Press.
    Gutierrez, R. Primary carcinoma of Cowper's gland. *Surg. Gynec. & Obst.*, 65: 238–248, 1937.
    Gutierrez, R. A new device for catching tissue in endoscopic prostatic resections. *Urol. & Cutan. Rev.*, 38: 91–93, 1934.
21. Mintz, E. R. and Smith, G. G. Autopsy findings in 100 cases of prostatic cancer. *New England J. Med.*, 211: 479–487, 1934.
22. Pasteau, O. Quoted in A Review of Urologic Surgery. *Arch. Surg.*, 37: 840, 1938.
23. Freyer, P. J. Cancer of the prostate. *Urol. & Cutan. Rev.*, 18: 69–75, 1914.
24. Hinman, F. The Principles and Practice of Urology. Philadelphia, 1935. W. B. Saunders.
25. Rolnick, H. C. Radical perineal prostatectomy for carcinoma. *J. Urol.*, 34: 116–121, 1935.
26. Pauchet, V. Le traitement du cancer de la prostate. *Paris chir.*, 16: 4, 1924.
    Pauchet, V. Tumeurs malignes de la prostate. *Encycl. fr. d'Urol.* 6: 281–360, 1923.
27. Chevassu, M. Quoted in A Review of Urologic Surgery. *Arch. Surg.*, 37: 843, 1938.
28. Jacobs, A. Transurethral resection of the malignant prostate. *Brit. J. Urol.*, 7: 321–329, 1935.

CYSTOTOMY FOR STONE IN CHILDREN

ROSWELL BROWN, M.D., F.A.C.S.

BUFFALO, NEW YORK

IN Hippocrates' time, lithotomy was performed by specialists. Perhaps this is the most ancient major surgical procedure which is still in use. Great progress in medical sciences has been made, but we are still using this operation, and we are still relatively ignorant of the real nature of the malady.

Urinary stones are manifestations of a variety of diseases. But there is reason to believe that nearly all of the cases of bladder stones during the first few years of life belong to one etiologic group. Many cases have been reported from the countries of southern Asia.[3,4,6] A few cases have been reported in the United States.[1,2,5] There is said to have been a marked decrease in the incidence of the disease in England, Germany and France during the past few generations.[3]

The disease is not rare in Syria. In four years at the American Presbyterian Hospital in Tripoli, Syria, sixteen children with urinary calculi came under treatment: thirteen bladder stones, two urethral stones, and one ureteral stone. Also, the author collected 125 such stones from six other surgeons in Syria and Palestine.* The results of a study of some of these specimens and considerations of etiology will be published elsewhere. Suffice it to say here that the geographic distribution in Syria is widespread, that most of the cases are in boys in the first decade of life, that the stones are usually solitary, and that they are not due to congenital malformations of the bladder neck.

The diagnosis of bladder stone in children usually presents no difficulties. The history is very characteristic. The Syrian parent may state the correct diagnosis in answer to the doctor's first question. The child micturates often, and he cries out with pain during the act. He grasps the glans penis. The stream may be interrupted suddenly. Occasionally there is a constant dribbling of urine from a full bladder; but this usually means that the stone is in the urethra. Priapism is a common symptom.

Physical examination gives little diagnostic information. One may find only excoriation of the penis.

The urine is usually clear, but it contains albumin and a few white blood cells. Gross pyuria is infrequent. Red blood cells were found in the urine in only four of thirteen cases. Gross hematuria seems to be a rare finding in this condition; in our series, it occurred only in the case of ureteral calculus.

Special diagnostic procedures, such as palpation by rectum or cystoscopic examination, may be used to prove the diagnosis. The simplest sure method is the passage of a small sound. *X*-ray examination is preferred because it is painless and does not traumatize. The stones can be visualized even when they are relatively radiotransparent, if the proper exposure is used. (Figs. 1, 2, and 3.)

The operation of crushing a bladder stone by means of a lithotrite which is passed through the urethra is successfully used by some operators. Any great disproportion between the size of the calculus and the size of the urethra requires cystotomy. Many Syrian peasants think that sterility is a late complication of the disease. This was a factor in leading us to avoid urethral instrumentation. Our cases were all treated by suprapubic cystotomy.

Little or no preoperative treatment is needed, as the urine is usually clean. The boy is kept in the hospital for at least

* Grateful acknowledgment is made of the help of Dr. Abdul Lateef Bisar, Dr. Harry Boyes, and Dr. Waheeb Nini of Tripoli, Dr. Ellis H. Hudson of Deir ez Zore, Dr. Herbert Torrance of Tiberias, and Dr. Ernest Wyder of Nazareth.

twenty-four hours before operation and methenamine is given by mouth.

A general anesthetic is required. Ether and oil administered by rectum is very satisfactory when the dosage is accurately computed on the basis of body weight.

Fig. 1. Age 2½ years. The *x*-ray picture suggested that the stone was in the urethra. It was found in the bladder.

The bladder is distended with sterile water or some suitable solution, such as boric acid. Catheterization is not necessary. Using an aseptic technique, the nozzle of an ordinary large syringe is introduced into the external meatus, and fluid is slowly injected until the bladder is a visible abdominal tumor. If the fluid is expelled, more anesthetic may be needed. One should not hesitate to distend the bladder well, for the operation involves far less trauma when there is no necessity of searching for the bladder.

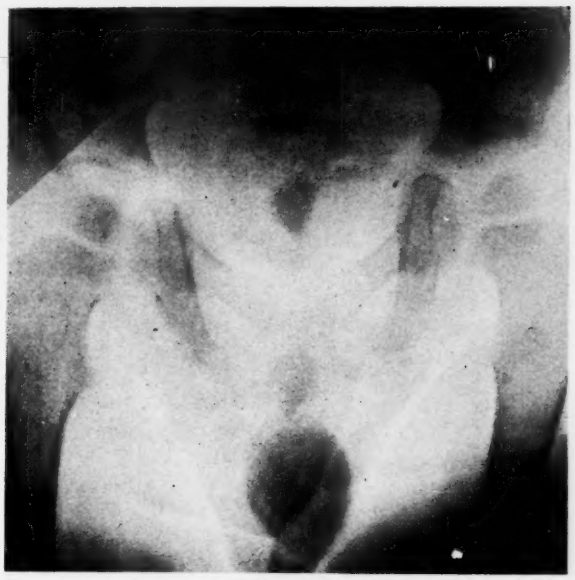


Fig. 2. Age 2 years. The stone shadow is seen superimposed upon the coccyx.

A midline suprapubic incision is made. Care is taken not to separate the layers of the abdominal wall any more than is necessary, as all the tissues exposed will be contaminated with diluted urine. The peritoneal reflection should be identified and avoided. The bladder is secured by guy sutures and opened by a stab wound which is extended laterally. The fluid is sucked out and the bladder is explored gently. The

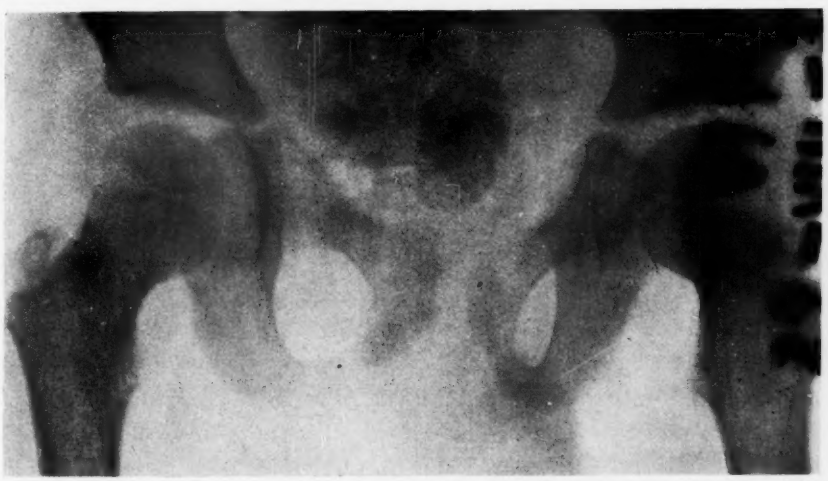


Fig. 3. Age 6 years. The stone shadow is situated above the symphysis pubis. The large eccentric nucleus shows clearly.

stone is removed either with forceps or spoon. Stone forceps with spoonlike blades are convenient, but not at all indispensible.

operative field by the assistant's finger in the rectum.

The wound in the bladder is closed

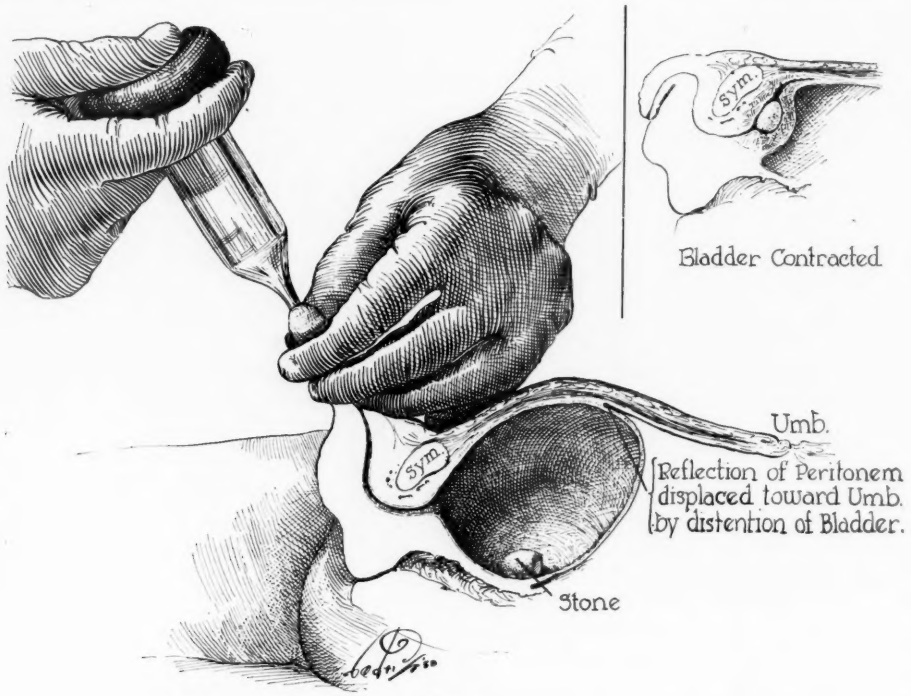


FIG. 4.

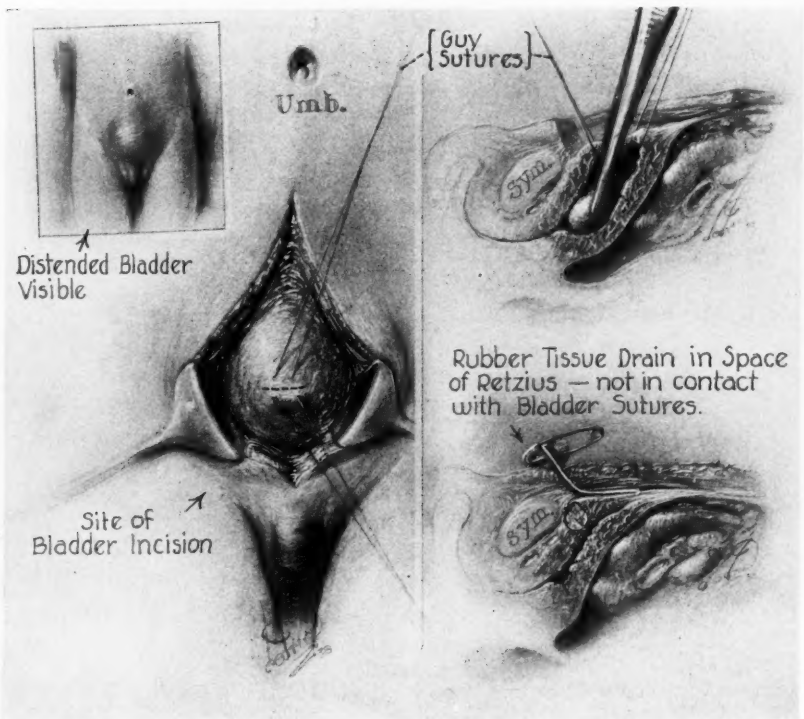


FIG. 5.

When the stone lies deep in the neck of the bladder, it may be delivered into the

snugly with a continuous stitch of plain catgut in the muscularis. The mucosal

layer is never stitched, because the presence of suture material in or near the bladder cavity tends to cause recurrence of stone. If the wound is small, it may be closed with a purse-string suture. A second line of suture may be used to invert the first, but, if the stitches are properly placed, one continuous suture is sufficient. The continuous stitch is better than interrupted stitches in the bladder because it tends to shorten the wound when it is drawn tight, and because it reduces knots to a minimum.

The wound is irrigated with warm saline solution. A small rubber tissue drain is left in the prevesical space, preferably not directly to the site of suture of the bladder. The abdominal wall is closed in layers, using fine chromic catgut in the anterior sheath of the rectus muscle.

No indwelling catheter is used. Soon after the child awakes from anesthesia, he micturates normally and is pleased to find that the act is painless.

The wound heals by primary intention. There is some reaction about the incision, redness and swelling, due to contamination with diluted urine at the time of operation, but no pus forms if ordinary precautions have been taken and the bladder sutures are competent. The drain is removed on the second or third day.

If the closure of the bladder is not tight, urine escapes about the drain and the dressings are soaked. In such a case, it is wise to remove all the stitches in the abdominal wall at once, and leave the wound open, to heal eventually by granulation. The convalescence is prolonged, but the end result may seem just as good as if primary union had occurred.

When there is pyuria with bladder stone in children, the condition may be grave, because this often means bilateral pyonephrosis. The patient should be carefully prepared for operation by rest, large amounts of fluids and medication. The bladder should be irrigated before operation. A suprapubic catheter should always be employed in the presence of pyuria.

The results of the operation are almost uniformly satisfactory, as reported to us by various surgeons in Syria. Only one recurrence has come to attention. In our own short series, there were no recorded recurrences and no deaths. One child was taken from the hospital in very poor condition; but there were subsequent reports that he recovered.

SUMMARY

1. Solitary urinary bladder stones in small boys are not uncommon in Syria.

2. A characteristic dysuria with interruptions suggests the diagnosis. *X*-ray or sounding proves it.

3. Most of the patients have relatively clean urine. Cystitis does not seem to be a marked feature of the disease.

4. Uncomplicated cases are treated by suprapubic cystotomy with immediate closure and without the use of a catheter.

REFERENCES

1. Campbell, M. F. Urinary calculi in infancy and childhood. *J. A. M. A.*, 94: 1753, 1930.
2. Collins, A. N. Urinary lithiasis in infancy. *Am. J. Dis. Child.*, 6: 245, 1913.
3. Joly, J. S. Stone and Calculous Disease of the Urinary Organs. London, 1929. Wm. Heinemann.
4. McCarrison, R. A lecture on the causation of stone in India. *Brit. M. J.*, 1: 1009, 1931.
5. Thomas, G. J., and Tanner, C. O. Urinary lithiasis in children. *J. Urol.*, 8: 171, 1922.
6. Thomson, J. O. Urinary calculus at the Canton Hospital, Canton, China. *Surg., Gynec. & Obst.*, 32: 44, 1921.

LYMPHOSARCOMA OF THE MAMMARY GLAND*

STUART W. HARRINGTON, M.D. AND JOSEPH M. MILLER, M.D.

Division of Surgery, The Mayo Clinic — Fellow in Surgery, The Mayo Foundation

ROCHESTER, MINNESOTA

A DEFINITE surgical axiom that masses in the breast should always arouse suspicion of carcinoma and be investigated is now fairly well established. Of the malignant changes that may be found in such nodules, adenocarcinoma is of course the most frequent. Sarcoma occurs much less frequently. There are also conditions in which the appearance of a mass in the mammary gland is the first sign of a systemic neoplastic process. Such cases must be differentiated from those of adenocarcinoma in order that appropriate treatment may be started. These systemic conditions include chloroma, with and without accompanying blood changes, lymphatic leucemia, lymphogranuloma of the Hodgkin type and lymphosarcoma. The two latter conditions may be either disseminated or sharply localized to the breast. To clarify the pathologic changes that may be associated with such nodules in the mammary gland, the collected cases have been reviewed. In general, three types of growth may be found: (1) those in which involvement of the gland is merely part of a widespread generalized process; (2) the less frequently appearing cases of an apparently localized lymphogranulomatous neoplasm which is subsequently found to be but a part of a systemic disease; and (3) localized lymphogranuloma and lymphosarcoma.

A small number of cases of chloroma in which the breast has been involved have been reported. The hematologic picture associated with this pathologic change is not constant.

Lymphatic and myeloid types of leucemia may be found or there may be no blood changes. The chief significance of chloroma is that it denotes a process of pronounced malignancy no matter what the blood may show. Of the seven cases of chloroma collected, blood examination was not done in two cases (Sheild and Earle), while in a third (Huber), it was done only after death. At this time, there was a considerable increase in leucocytes that resembled the cells found in the tumors.

Acute lymphatic leucemia accompanying the chloroma was reported by Trevithick and by Weinberger. Simon's patient is of particular interest in that she was thought to have a malignant tumor of the breast, perhaps a carcinoma, when she first presented herself. She was a 16 year old girl who had noted a small swelling in the left breast for about four weeks. Growth of the tumor was rapid and the entire mammary gland became involved. She had not suffered a loss of weight, although she was pale and ill. A large, hard, non-tender nodule, to which, in part, the skin was attached, was found in the left breast. Venous dilatation was present in the skin, but the tumor was movable on the pectoral muscle. A small node was present at the edge of the tumor and the axillary lymph nodes were involved. The spleen was not enlarged, but a palpable nodule was felt during the rectal examination. With malignancy in mind, a radical amputation of the breast was performed. On cross-section, the tumor and lymph nodes were green in color and this suggested a diagnosis of chloroma. The day following operation, examination of the blood revealed that the patient had an acute myeloid leucemia.

An associated increased leucocyte count was not present in Reid's patient, a 30

* Abridgment of portion of thesis submitted by Dr. Miller to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Surgery.

year old married woman who was admitted with complaints of vomiting, icterus and mammary tumors. She stated that five

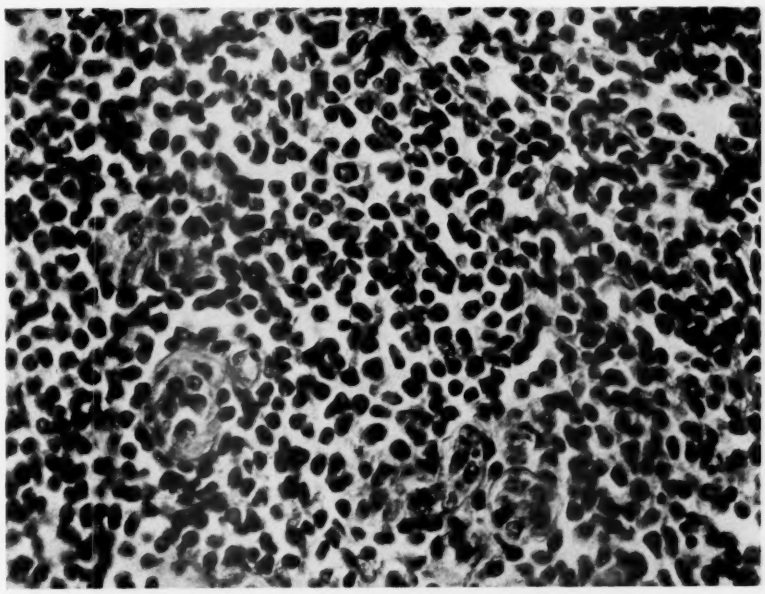


Fig. 1. Lymphosarcoma (× 420).

and a half months before admission, she had noted a small nodule in her left breast. This mass increased in size and she then found three small nodules in her right mammary gland. Both breasts were treated with radiotherapy for three months, with the left breast receiving most of the treatment. A good response in the left mammary gland was noted and the tumor almost disappeared but it was soon replaced by another in spite of the radiotherapeutic treatment. The right breast was uninfluenced by this therapy. Five months after the onset of the disease, nodules in the left axilla were noted. Icterus was present upon admission. With the exception of the nodes in the left axilla the superficial lymph nodes of the body were not enlarged and there was no increase in substernal dulness. Heart and lungs were normal but there was some tenderness in the gall-bladder region, and two leiomyomas were thought to be present in the uterus. The patient's leucocyte count at this time was 6,200 in each cubic millimeter of blood.

At the first operation, the right breast was removed and a choledochostomy for stricture of the common bile duct was performed. A biliary fistula subsequently developed. One month after the initial operative procedures, the left mammary gland and axillary nodes were removed. A second white count the day after this operation was 7,500. The tumors in both breasts and the axillary lymph nodes were green. Two weeks before death, the patient's home physician found a tumor in the rectum which he considered a sarcoma. Death occurred nine months after the first appearance of the mammary tumors. This case is remarkable, for the only objective evidence at first that the patient suffered from chloroma was the presence of the mammary neoplasms.

The breast may also be the seat of metastatic deposits in lymphatic leucemia without the presence of chloroma. Dencker's patient had a widespread dissemination of lymphatic cells and the mammary glands were almost replaced by neoplastic tissue. The white blood cell count was 710,000 per cu. mm., with 82 per cent small lymphocytes and 6 per cent large lymphocytes.

Similar to Reid's case, in which the first sign of disease was the appearance of a mammary tumor, are the cases of McWilliams and Hanes and of Haram. Two weeks

before admission, the patient of the former men noted a mass in the right breast which apparently was not growing. The opposite

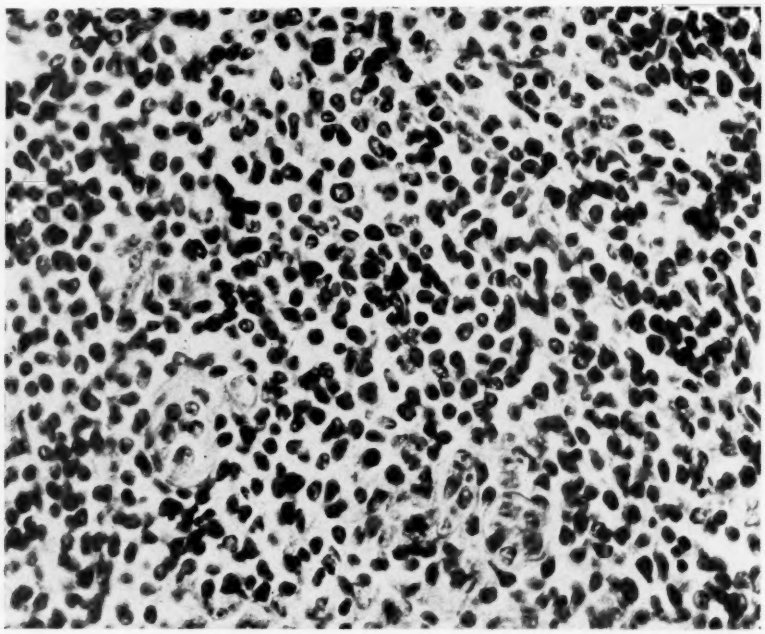


Fig. 2. Lymphosarcoma (× 130). Note closely packed areas of malignant cells.

breast was considered to be normal. Removal of the nodule and subjection to microscopic investigation revealed that a benign lymphoma was present. However, another mass appeared in the breast and then its mate became involved, all the tumors growing steadily. Both mammary glands were removed, first the right and then the left after an eight day interval. A diagnosis of lymphosarcoma of each breast with involvement of the right axillary lymph nodes was then made, but subsequently a lymphatic leucemia was discovered.

Haram has reported a similar case of lymphatic leucemia in which the only gross manifestations were in the breasts. The tumor removed from the left breast had a pathologic appearance simulating a sarcoma, with dense infiltration by large mononuclear cells. Five months later, a tumor of the same structure was removed from the right mammary gland. Examination of a blood film at the time of the first surgical procedure showed no abnormality, but after the second operation the white blood count was 17,800, 99.5 per cent being lymphocytes.

Schultz, in the handbook of Lubarsch and Henke, gave details about two patients who had a widespread lymphogranuloma in which both breasts were infiltrated. Microscopic examination of the tissue from the first patient revealed a typical picture of Hodgkin's disease with lymphocytes, eosinophiles, Sternberg giant cells and much connective tissue. Generalized involvement was also present in the other case, but Sternberg cells and eosinophiles were not part of the microscopic picture of the lymphogranuloma. Schultz also included a case from the Vienna Pathological Institute in which the patient had a dissemination which was again widespread. Lymphocytes, Sternberg cells and new connective tissue were the prominent microscopic features of the tumor tissue.

Lymphogranuloma has appeared as an isolated tumor, as in the case of Kückens. A 16 year old girl had a mass in her right breast for several weeks. This was treated conservatively, but owing to an increase

in size, the thought that it might be a malignant lesion became more prominent. The neoplasm had no connection with the ribs or intercostal spaces, there was no enlargement of the cervical, inguinal or abdominal lymph nodes and the spleen was not enlarged. At operation, the right breast and underlying muscles were found to be infiltrated with a grayish-white hyperplastic tissue which upon microscopic examination was found to be richly cellular and remarkable for the high content of eosinophilic leucocytes. Moderately numerous small foci of necrosis and proliferation of connective tissue cells and Sternberg giant cells were also present.

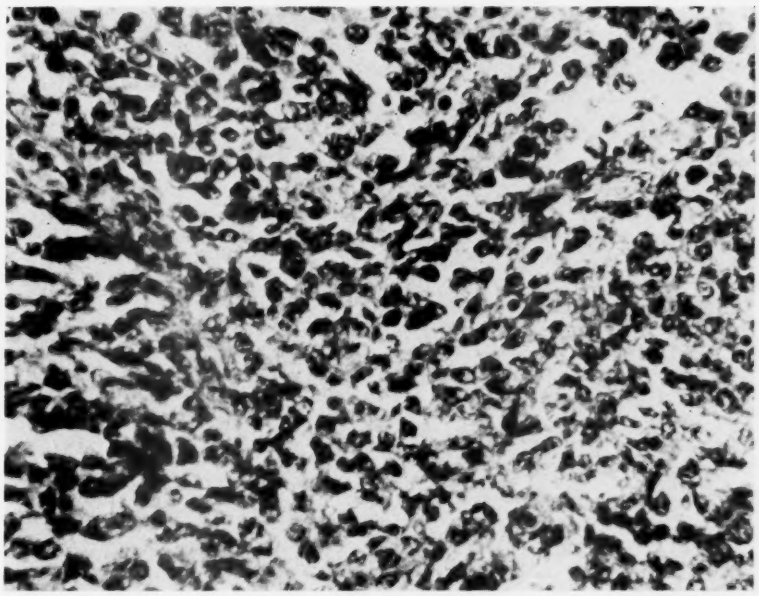


Fig. 3. Enlargement of Figure 2. The malignant cells are of "medium" size.

Somewhat similar is the patient of Risak. This 67 year old married woman had noted a swelling in her right axilla for three months. The right nipple was retracted and, after a diagnosis of mammary carcinoma had been made, a radical amputation was done. The breast showed a "chronic cystic mastitis," but the lymph nodes which had extended into the mammary tissue were involved by a lymphogranulomatous process. No mention was made of blood changes and no microscopic description of the lesion was given. Kreibig has added some details to this case. The patient received Roentgen treatment for twelve months, and four months later (sixteen months after operation), a tumor was noted in the left breast and there was enlargement of the left axillary lymph nodes. The spleen was slightly enlarged. Further Roentgen treatment caused a disappearance of the infiltration.

Lymphosarcoma, as part of a generalized process, has been described by Kundrat and by Schoen. The former discussed the case of a 38 year old woman from Störk's clinic in which the outer half of the left breast had been removed, apparently for carcinoma. However, there was widespread involvement of the body and both breasts at a later date. Schoen also noted that both breasts were involved in a case of lymphosarcoma in a 39 year old man with gynecomastia. Amputation of the left breast because of a tumor thought to be carcinoma was described by Ghon and Roman in a 44 year old married woman, who was later discovered to have a lymphosarcoma of the anterior mediastinum which became widespread. Elsberg briefly referred to a patient in whom multiple tumors developed in both breasts. A simultaneous radical amputation was done, and a diagnosis of round-cell sarcoma

of the lymphosarcoma type was made. The mammary glands but not the axillary lymph nodes were involved.

Somewhat more unusual is the patient of Judson, who was thought to have a carcinoma of the left breast with axillary metastasis. After radical amputation, an adenocarcinoma of the mammary gland was reported, but the lymph nodes were considered to be involved by a benign lymphoma. However, recurrences of tumors in the submaxillary region, the tonsil and other regions occurred and this patient too was discovered to have a lymphosarcoma.

REPORT OF CASES

Two lymphosarcomas in which the mammary gland has been involved have been observed at The Mayo Clinic.

Case I. The first occurred in a 28 year old white married woman with a negative family history of malignant lesions, who complained of weakness of a year's duration, palpitation, nausea and vomiting, which were most frequent at the time of her periods, and headache. The latter had been present for eight to ten years and originated in the frontal region, then extending to the occipital region. The patient's appetite had been fair and she had not lost any weight.

Upon physical examination, a large nodular mass was found in the upper lateral portion of the right breast and a second smaller nodule in the left mammary gland, with a palpable lymph node present in each axilla. The heart and lungs were considered normal. Blood pressure was 135/80. Some abdominal tenderness was present. The concentration of hemoglobin (Dare) was 76 per cent, the erythrocytes numbered 4,700,000 and the leukocytes 3,200 in each cubic millimeter of blood. Wassermann reaction was negative. Roentgenographic examination of the chest revealed an old calcification of the upper lobe and apex of the right lung, which was suggestive of an old tuberculous lesion.

At the time of operation, a hard nodule in the upper quadrant of the right breast was removed and after pathologic examination, a radical amputation was performed. Multiple foci of lymphosarcoma, the largest 5 cm. in diameter and the smallest 1 cm. in diameter, were present. The axillary lymph nodes were not involved. Removal of a nodule from the left breast at the same time revealed a similar type of malignant deviation 2 cm. in diameter. A subsequent roentgenogram of the chest revealed a mediastinal mass not attached to the aorta. After a course of radiotherapy an ulceration subsequently developed at the base of the tongue and epiglottis which filled up the sulcus in this locality. There was some edema of the arytenoid muscles and the aryepiglottic folds with ulceration. It was suggested that this process might be either part of the lymphosarcomatosis or possibly a primary infection. The patient became worse and died a little more than seven weeks after she was first seen.

Under the microscope, the portion of the mammary gland affected was seen to be very cellular and nothing of the structure characteristic of breast tissue remained. (Fig. 1.) The stroma was small in amount and eosinophilic, with blood vessels relatively few in number. The amount of cytoplasm in the individual cells was small, dark staining nuclei occupying the major portion of the cell. The nuclei were both anisocytotic and poikilocytotic, and the chromatin material was granular and uniformly distributed throughout the nuclear body. Many prominent nucleoli and a few mitoses were seen. The pathologic picture was that of lymphosarcoma.

Case II. Somewhat more unusual is the second case. A 38 year old married woman stated upon admission that she had noted a lump in her breast for ten days. There was no family history of malignant lesions. There had been no discharge from the nipple, and no loss of weight or strength. The patient was moderately obese. Enlargement of the superficial lymph nodes could not be demonstrated. A small nodule was found in the lower part of each lobe of the thyroid. In the left breast a firm movable nodule about 3 cm. in diameter was found, with the skin overlying the mass retracted, but the nipple normal. Pathologic changes were not demonstrable in the right breast. A soft systolic murmur was heard all over the precordium, but the lungs were clear and resonant throughout. The abdomen was normal. A large fibroid uterus was discovered upon bimanual examination.

The hemoglobin was 12.9 Gm. per 100 c.c.; erythrocytes numbered 4,100,000 and leuco-

cytes 6,300. The results of roentgenographic examination of the chest were normal.

The tumor was excised and after the pathologic report, the operation was completed as a radical procedure. An uneventful convalescence followed. Upon leaving the hospital, the patient was given a course of Roentgen therapy and advised to have a second course in a month. Upon her return about four months later, no evidence of recurrence was found and a hysterectomy was carried out. This patient was well and without return of her malignant lesion six years after her operation.

The microscopic examination of the tissue removed from the breast was all the more interesting in the light of the patient's postoperative course. An extremely cellular structure without definite arrangement could be seen under the microscope. (Figs. 2 and 3.) Nothing suggestive of the mammary gland was present; the glandular tissue had been replaced by tumor tissue. Under oil immersion, the neoplastic cells were seen to be manifestly malignant and contained a little cytoplasm eosinophilic in nature. The nuclei were hyperchromatic and irregular in size and shape. Many were large and clear staining with prominent nucleoli, and some were of horseshoe shape. However, the cells were not of the Sternberg type, and eosinophiles and plasma cells were absent. Many mitotic figures, a scanty stroma and a small number of thin walled blood vessels are seen. The picture was that of a malignant lymphosarcoma.

The explanation for the presence of a primary lymphosarcoma of the breast is rather difficult since lymph follicles are not ordinarily located there, but the following suggestion may be made. Large collections of lymphocytes are found in the mammary gland in most chronic pathologic entities affecting the breast. Secondary lymph follicles may be formed and a continuation of the stimulus, whatever it is, may produce a malignant change. Although difficult to explain, an excellent result has been achieved in Case II. This patient represents a rare case of a "five-year cure."

In both cases presented, the diagnosis was not and could not have been made until operation, for differential diagnosis from carcinoma rested upon microscopic examination. However, in some of the cases reviewed, the diagnosis could have been reached by a routine preoperative examination of the blood. Every patient who has a mass in the breast upon which surgical intervention is contemplated, should have a careful physical examination and, besides the various necessary laboratory examinations, a leucocyte and differential count. The conditions falling into the various categories described previously will be recognized and appropriately treated. Where blood changes are not present, the tumor in the breast should be removed and, if a lymphogranuloma or a lymphosarcoma is found, radiotherapy should be instituted.

SUMMARY

The collected cases of lymphosarcoma of the mammary gland have been reviewed and three types of growth described. Accompanying blood changes of significant character are sometimes present and should not be overlooked before operation is undertaken. Evidence of lymphosarcomatosis may at first be only found in the breast, later to appear in other localities (Case I), but it may also be primary in the mammary gland (Case II). These case histories are given in detail and their surgical treatment is presented.

REFERENCES

1. Dencker, Christian. A case of extensive leukemic infiltration of the mammary gland and skin. *J. A. M. A.*, 56: 417, 1911.
2. Earle, Henry. A case of diseased testicle, accompanied with disease of the lungs and brain, and terminating fatally. (Communicated by Lawrence, William.) *Tr. Med.-Chir. Soc. London*, 3: 59, 1812.
3. Elsberg, C. A. Multiple lymphosarcoma of both breasts. *Ann. Surg.*, 60: 767, 1914.
4. Ghon, A., and Roman, B. Über das Lymphosarkom. *Frankfurt. Ztscbr. f. Patb.*, 1: 138, 1916.
5. Haram, B. Lymphatic leukaemia with bilateral mammary changes: report of a case. *Lancet*, 1: 1277, 1937.
6. Huber, Karl. Studien uber das sogenannte Chlorom. *Arcb. f. Heilk.*, 19: 129, 1878.
7. Judson, H. A. Simultaneous lymphosarcomatosis and carcinoma of the breast in the same individual. *Radiology*, 29: 578, 1937.

8. Kreibig. Discussion. *Zentralbl. f. allg. Path. u. path. Anat.*, 54: 109, 1932.
9. Kückens, Hans. Ein lokales Lymphogranulom der Brust in Form eines Mammatumors. *Beitr. z. path. Anat. u. z. allg. Path.*, 80: 135, 1928.
10. Kundrat. Ueber Lympho-Sarkomatosis. *Wien. klin. Wchnschr.*, 6: 211, 234, 1893.
11. McWilliams, C. A., and Hanes, F. M. Leukemic tumors of the breast mistaken for lymphosarcoma. *Am. J. M. Sc.*, 143: 518, 1912.
12. Reid, Mont. Ueber ein doppelseitiges myeloides Chlorom der Mamma. *Beitr. z. klin. Chir.*, 95: 47, 1914.
13. Riska. Über zwei seltene Erkrankungen der weiblichen Brustdrüse. *Zentralbl. f. Chir.*, 56: 403, 1929.
14. Schoen, Rudolf. Lymphosarkomatose mit Beiteiligung der Brüsts bei einem Gynakomsten. *Frankfurt. Ztschr. f. Path.*, 25: 112, 1921.
15. Schultz, A. Pathologische Anatomie der Brustdrüse. In Lubarsch, O., und Henke, F. Handbuch der speziellen pathologischen Anatomie und Histologie. Berlin, 1933. Julius Springer, vol. 7, pt. 2, pp. 1–208.
16. Sheild, A. M. A Clinical Treatise on Diseases of the Breast. London, 1898. Macmillan.
17. Simon, W. V. Myeloische Chloro-Leukämie (Chlorom) unter dem Bilde eines malignen Mammatumors. *Berlin. klin. Wchnschr.*, 1: 893, 1912.
18. Trevithick, Edgar. A case of chloroma, with clinical history and account of post-mortem appearances. *Lancet*, 2: 158, 1903.
19. Weinberger, M. Ueber lymphoides und myeloides Chlorom, sowie dessen Beziehungen zur lymphoiden und myeloiden Leukämie. *Ztschr. f. Heilk.*, vol. 28, 1907. *Abt. f. inn. Med.*, 1–97.

In cases of senile arteritis, at the earliest possible moment I do a periarterial sympathectomy, an arteriectomy, or a lumbar sympathectomy according to the particular case. In this way it is possible to relieve almost all elderly sufferers from senile arteritis, if a general examination shows that they have no uremic or glycemic conditions which contra-indicate operation.

From—"Surgery of Pain" by René Leriche (Williams and Wilkins).

BENIGN UTERINE HEMORRHAGE IN NONPREGNANT WOMEN

EDWARD A. SCHUMANN, M.D., F.A.C.S.

PHILADELPHIA, PENNSYLVANIA

UTERINE bleedings in the nonpregnant woman which are not the result of malignant tumors are commonly called benign hemorrhages. The term is a misnomer, since hemorrhage is, per se, an evidence of some abnormal process and cannot be benign. Hence the use of these two words as apposites is manifestly erroneous. However, it is common medical usage, and is generally understood to mean hemorrhage from causes other than malignant growths.

The subject is a very large one and perforce can only be reviewed in a somewhat cursory fashion in a communication such as the present one.

BLEEDING IN EARLY LIFE

Bleeding from the female genitalia of pathologic origin may occur at any time from birth to the last day on earth of the oldest woman; and because of this it is convenient to divide genital hemorrhage into several age groups, corresponding to the various physiologic cycles of the organs of reproduction. During infancy and childhood genital hemorrhage may be due to:

Precocious menstruation.

Nongenital hemorrhage of the newborn.

Malignant tumors of the lower genital tract (sarcoma botryoides).

Rarely, bleeding from violent inflammation of the mucosa in gonorrheal vulvovaginitis.

Precocious menstruation is seldom seen, there being but a few hundred cases in the literature. (Lenz was able to collect only 130 cases from 1680 to 1913.)

In some instances where the precocity is not extreme, the phenomenon may be due to some individual variation in the responsible endocrine mechanism; but where menstruation occurs at a very early age, the cause is usually some definite lesion in one of the ductless glands. The rare granulosa cell tumor of the ovary is a recognized cause. These malignant growths are follicular in their structure, and hence can readily stimulate the infantile endometrium to a point of bleeding comparable to menstruation.

Sarcoma of the ovary, large cysts, and teratomata have also been reported as causative. Tumors of the suprarenal gland, the pineal may be factors. Indeed, as Novak says, it is rare not to find a tumor of one of the endocrine organs in cases of menstrual precocity of extreme grade.

In some of these interesting cases the catamenia continues steadily from its early onset to the menopause. In most, however, it is regular for a while and then ceases, to recur again at the usual age of puberty.

Nongenital hemorrhage of the newborn is bleeding, rarely massive, often only discovered by the presence of blood cells in the microscopic examination of vaginal smears. It is probably due to the sudden withdrawal of estrin from the fetal circulation after delivery.

The uncommon finding of grape-like masses of sarcomatous tissue filling the vagina of infants will explain the bleeding from this cause. Occasionally vulvovaginitis due to an especially virulent strain of the gonococcus produces a violent inflammatory reaction in the vaginal mucosa with more or less bleeding.

All in all, genital hemorrhage in infants and young girls is uncommon, and each case requires most careful study to determine the etiologic factors involved.

BLEEDING IN YOUNG ADULTS

Hemorrhage in young adults may be caused by:

Systemic disease.

Malignant tumors of the corpus or cervix uteri.

Adnexal inflammatory disease.

Polyps of the cervix or corpus uteri.

Endocrine unbalance, "the hemorrhage of adolescence," "functional hemorrhage."

The bleeding may take the form of menorrhagia or metrorrhagia. Usually the former is the functional variety while the latter is characteristic of inflammatory lesion, polyp or neoplasm formation.

Systemic disease is far more prone to lead to amenorrhea or oligomenorrhea than to excessive menstruation; but syphilis is sometimes responsible for profuse hemorrhage, while chronic valvular heart disease is a definite cause. The anemias, tuberculosis, etc., do not often tend to excessive menstruation. Malignant tumors of the uterus, while uncommon in young women, are being reported with increasing frequency—as witness a girl now under the care of the writer, who at the age of 22 is suffering from a far advanced epidermoid carcinoma of the cervix which bled so freely as to cause a profound anemia.

Adnexal inflammation as a cause of metrorrhagia and menorrhagia is often overlooked. Béclère[1] has observed in four years sixty-five cases of functional uterine bleeding due to genital infection, most often caused by the gonococcus. This author believes that the bleeding is due to a secondary ovarian dysfunction.

Every active gynecologist has observed young women patients in whom irregular, sometimes profuse, uterine hemorrhage, together with other pelvic symptoms, led to the diagnosis of extrauterine pregnancy, but in whom laparotomy disclosed a subacute salpingitis.

Uterine or cervical polyps, too, are not common in young women, but may occur; and when present, disclose their usual tendency to irregular small hemorrhages often induced by exertion, coitus, douching and so on.

Endocrine unbalance is probably the most common variety of menstrual bleeding noted in young girls. This so-called functional bleeding may occur at any period during the cycle of reproductive life. Büttner, Novak[2] and others feel that it is most common during middle life, after 40, the proportion varying from 51 per cent to 77 per cent of the total number in various groups of statistics.

Functional hemorrhage during puberty and early adolescence forms but a small fraction of the whole number of cases, usually stated as accounting for from 5 to 10 per cent, but in the experience of the writer even this proportion is too high, 2 or 3 per cent seeming to be nearer the truth.

The whole subject of functional hemorrhage is still in a state of flux, students of this phenomenon varying widely in their interpretation of its mechanism. It has been widely accepted that functional uterine bleeding is almost invariably associated with endometrial hyperplasia, and this concept is responsible for the corollary view that, if the hyperplastic endometrium can be converted into the secretory phase, bleeding will cease. This is the basis of endocrine therapy, some form of the luteinizing hormone being utilized to bring about a secretory phase.

Recent study, however, has demonstrated to the satisfaction of an increasing number of investigators that the relationship of bleeding to endometrial hyperplasia is by no means a constant one, and that many exceptions are found to it. Payne[3] studied the clinical records of 534 patients with endometrial hyperplasia in the effort to determine its rôle in uterine hemorrhage at various ages. Abnormal bleeding was present in only 85 per cent of the premenopausal hyperplasias. Payne concludes that just as hyperplasia may occur without abnormal bleeding, so may abnormal bleeding occur without hyperplasia. In approximately two-thirds of the cases of functional uterine hemorrhage endometria were obtained which were devoid of hyperplasia.

Jones[4] found that in eighty-three consecutive cases about 14 per cent were

associated with secretory endometrium. He studied in detail forty-one cases of functional uterine bleeding in which secretory endometrium was found. Greenhill, in his editorial comments in the Year Book of Obstetrics and Gynecology, emphasizes the fact that almost any type of endometrium may be found in these cases, which, he believes, is the reason that response to treatment is so variable. A series of cases now being studied at Kensington Hospital for Women by the writer and his associates seems to indicate that in the climacteric and postclimacteric bleedings atrophic endometrium, almost aglandular, is far more common than any other variety.

BLEEDING DURING MIDDLE LIFE

Bleeding during the middle decades of life may be due to:

Functional causes.

Benign neoplasms mostly fibromyomata.

Malignant neoplasms.

Endometriosis, endocervicitis, polyps and adnexal disease.

Hypertensive cardiorenal disease.

In the middle years, say from 35 to 55, uterine hemorrhage has a greater variety of causative agents than obtains either during youth or in old age. Here the benign tumors play a most important part, and endo-cervicitis with erosion following the traumatisms of parturition is often responsible for bleeding. Cancer of the fundus as well as the cervix is all too common a factor.

An interesting analysis of the records of patients suffering from uterine hemorrhage, excluding all those cases in which pregnancy was a factor, has been published by Weintraub,[5] who found that in 4,421 admissions on the gynecologic service of a general hospital, 738 patients, or 16.6 per cent of the whole number, complained of abnormal uterine bleeding not associated with pregnancy.

Of these 738 patients, the bleeding was due to:

Fibroid tumors in 340 (46 per cent).

Endometrial hyperplasia in 175 (23.7 per cent).

Fibrosis uteri in 68 (9.2 per cent).

Non-malignant polyps in 49 (6.6 per cent).

Malignant neoplasm—cervix and corpus in 28 (3.7 per cent).

Chronic pelvic inflammatory disease in 24 (3.2 per cent).

Benign ovarian neoplasm in 18 (2.4 per cent).

Anatomic displacements in 29 (3.9 per cent).

Undetermined origin in four patients.

This ratio agrees with that generally observed except in the very low incidence of carcinoma uteri. Weintraub explains this in part by citing the well-known comparative immunity to cervical cancer enjoyed by Jewish women. It may also be true that in the locality in which this hospital was situated, most cancer patients are cared for in special institutions. Certainly, speaking generally, carcinoma would account for far more than 4 per cent of a series of patients suffering from uterine hemorrhage.

The hemorrhage resulting from the presence of uterine fibroids depends much upon the mechanism of tumor growth. In those of the centrifugal type, whose growth tends away from the uterine cavity and toward the serosa, hemorrhage either is negligible, or continues to decrease as the tumor grows away from the center.

In centripetally growing tumors, on the other hand, the blood tends to increase steadily as the growth impinges more and more upon the uterine cavity, bringing the opposite endometrial surfaces together with sufficient pressure to cause superficial necrosis of these surfaces with vessel rhexis.

The bleeding may be of either menorrhagic or metrorrhagic type, the former being more common at first, being succeeded by irregular or indeed, almost continuous hemorrhage in many instances.

Hemorrhage resulting from the presence of malignant neoplasms requires but little

discussion here. The slight but persistent spotting, with more and more profuse menstrual periods culminating in a sudden massive hemorrhage forms a picture all too well recognized by the gynecologist.

In corporeal carcinoma spotting is not so common, the bleeding only beginning when the growth is fairly well advanced and then developing as a steady flow.

Bleeding in the late decades of life, postclimacteric bleeding, may be caused by any of the foregoing lesions, with the addition of senile vaginitis, which often is responsible for slight to moderate hemorrhages.

THE DIAGNOSIS AND TREATMENT OF UTERINE HEMORRHAGES

The diagnosis of the cause of uterine bleeding should always be regarded as a matter of major importance, and no detail of examination should be omitted which may lead to a correct interpretation of the etiology.

Increasing knowledge of functional hemorrhage and its treatment by means of endocrine preparations has resulted in many unfortunate instances wherein patients presenting themselves with uterine bleeding have been cursorily examined, assumed to be suffering from functional hemorrhage, and managed by various dosages of various endocrine products. Many early uterine malignancies have been overlooked in this manner, and any active gynecologic clinic can report all too large numbers of late, far advanced cervical and corporeal carcinoma which have followed prolonged medical treatment without exhaustive efforts at excluding such malignant growths.

In the writer's hospital services no patient is treated upon an assumption of functional hemorrhage without a definite knowledge as to the histology of the endometrium, a knowledge gained by the examination of the entire endometrium as removed by the curette, or at least by the study of endometrial biopsy specimens.

The ordinary diagnostic measures should be utilized in arriving at a conclusion. The detailed history, the exclusion of nongenital, systemic causes of bleeding, the careful bimanual and speculum investigation, all go without saying. The same general statements may be made concerning treatment. Fibromyomatas are to be managed by hysterectomy, myomectomy or radium and *x*-ray according to the requirements of the individual case. Malignant neoplasms are treated by surgery or irradiation, or both, as the case may be. Polyps are excised, pelvic inflammatory disease managed according to the usual plan.

FUNCTIONAL HEMORRHAGE

There remains to be considered the treatment of functional hemorrhage, which is still somewhat confused in the minds of many of us. The bleeding may be attacked from one of several avenues:

1. Conversion of an abnormal endometrium into a secretory phase of this structure.
2. Endocrine therapy not intended to affect the endometrium directly but to regulate a general endocrine unbalance.
3. Compression of blood vessel walls—by stimulations of uterine musculature, ergot, cotarmine chloride (stypticin), breast stimulation, etc.
4. Decreasing the blood coagulation time, moccasin venom, koagamin, cevitamic acid and vitamin C.
5. Blood transfusion.
6. Surgery.

In the management of functional uterine bleeding, it is often necessary, first, to control the immediate hemorrhage, and then to institute measures designed to prevent its recurrence.

STIMULATION OF THE UTERINE MUSCLE

Uterine hemorrhage may sometimes be controlled by the exhibition of drugs which act by compression of the blood vessels, and for this purpose the newer oxytocic principles of ergot are valuable agents.

Preparations of this new alkaloid, ergonovine, are marketed under various proprietary names, and should be administered orally in small dosage (1/320 gr.) every four hours for six or eight doses. These powerful preparations may not be used for a long time since gangrene of the extremities may follow their prolonged administration.

REDUCTION OF BLOOD COAGULATION TIME

Control of bleeding by shortening the clotting time has been employed for some time with more or less success. Parathyroid extract has been advocated, on the principle that its use increases the amount of calcium in the circulating blood.

Moccasin snake venom has also enjoyed a considerable popularity as a clotting agent, especially for its effect upon the lesser vessels and the arterioles. The venom in dilutions of 1:3000 may be given hypodermically daily for two weeks, 0.5 cm. being the initial dose, which is increased in two days to 1.0 cc. Local reaction may follow its use.

Irradiation of the spleen has been advised in the view that the blood platelets are increased by the *x*-ray. The writer has no experience with this method.

Koagamin. Recently Steinberg and Brown of the Research Foundation, Kensington Hospital for Women, presented their work on the reduction of clotting time with *koagamin*, an extract containing oxalic acid and possibly vitamin K. This preparation has been extensively used by the writer with signal success. The drug is given intravenously in a dose of 3 c.c., which is followed by 2 c.c. intramuscularly every four hours for two to four doses. Within fifteen minutes of administration the clotting is reduced, sometimes as much as 50 per cent, and the effect lasts for from eight to ten hours.

ENDOCRINE TREATMENT

This is probably the therapeutic measure in most widespread use at this time. The preparations used are chorionic gonadotropic hormones, as for example, antuitrin S, A. P. L. or antophysin. More recently extracts made from the blood of pregnant mares, gonadin or gonadogen, have been employed, but since these substances are derived from horse serum a skin sensitivity test is requisite before use.

All of these gonadotropic agents probably act by producing atretic changes in the ovaries.

The dosage varies, but the chorionic hormones are usually exhibited in intramuscular injections of from 100 to 1000 rat units daily for two days.

In connection with the above therapy, the anemia which results from severe hemorrhage must be treated by the ordinary measures employed for this purpose. Blood transfusion is of the greatest value after massive blood loss, and may be followed by the administration of iron in its various forms, lextron, and so on.

Treatment to prevent recurrences of functional bleeding consists in trying first the effect of the gonadotropic hormone as described above, the injection being begun ten days before the expected menstrual period. When the bleeding begins, koagamin may be given. Should this therapy fail to control the periodic hemorrhages, more radical procedures become necessary, and either irradiation of the uterus and ovaries by radium or *x*-ray or hysterectomy must be seriously considered.

Radium treatment is a valuable measure in combating uterine hemorrhage, but is subject to several contraindications. Radium may not be used in the presence of pelvic inflammatory disease, a series of cases of fatal peritonitis following such treatment being available in the literature.

In the opinion of the author, radium is not satisfactory, generally speaking, in the treatment of functional bleeding in women before the climacteric age. While it is theoretically possible so to regulate dosage that menstruation may be made to

cease for a predetermined period, later recurring, it is a fact that the individual response to radiation is extremely variable, and a complete menopause all too often follows what was intended as a purely temporary measure.

Furthermore, it seems true that radiation menopause in younger women is productive of more violent and prolonged nervous disorder than that following surgical castration.

The same objections hold for *x*-ray termination of ovarian function. After the climacteric age, however, radium and *x*-ray are measures of the greatest value, and may be employed without hesitation upon the proper indications.

Hysterectomy, with or without removal of the ovaries, may be necessary occasionally. Needless to say, this is a somewhat radical treatment, but often produces a gratifying end result.

Time does not suffice for a discussion of the adjuvant measures utilized in the management of uterine bleeding. The discovery and control of associated pathologic conditions, proper maintenance of nutrition, elimination of psychic disturbances, and the like—all of these are necessary details if a bleeding woman is to be restored to normal health.

REFERENCES

1. Béclère. *Bull. Soc. gynec et obst.*, 27: 507, 1938.
2. Novak, E. Curtis Obst. & Gyn. Phila., 1933. Saunders, 1: 126.
3. Payne, F. L. *Am. J. Obst. & Gynec.* 36: 302, 1938.
4. Jones, H. W. *Am. J. Obst. & Gynec.* 35: 64, 1938.
5. Weintraub, F. *Am. J. Obst. & Gynec.* 36: 476, 1938.

ACTIVE IMMUNIZATION AGAINST TETANUS BY THE COMBINED SUBCUTANEOUS AND INTRANASAL ROUTES

A SIMPLE PROCEDURE FOR THE MAINTENANCE OF A PROTECTIVE ANTITOXIN TITER

HERMAN GOLD, M.D.

CHESTER, PENNSYLVANIA

ACTIVE immunization against tetanus is regarded by many as a safe and efficacious procedure.[1–10] It requires the injection of a primary course of two doses of alum precipitated tetanus toxoid or three doses of plain toxoid, which confers a basic immunity, to be followed by the injection of a "repeat" dose of toxoid whenever an injury occurs.

The repeated injection of toxoid immediately raises the question of sensitization. Another question of importance is the rate of antitoxin production following the injection of the repeat doses of toxoid. Finally, although local reactions at the site of injection are slight to moderate in severity, any procedure that requires the repeated use of "the needle" with subsequent sore arms is likely to meet with objections on the part of the patient.

The intranasal route has been successfully used for the administration of drugs, glandular extracts and various biological products.[11–18] Lesne et al.,[23] Salviolo,[24] Jensen,[25] Bousfield and King-Brown,[26] and more recently Wenger, Hampil and Masucci,[27] have reported on the use of diphtheria toxoid intranasally. Ramon and Zoeller[19–22] have also reported on intranasal immunization against diphtheria, tetanus, scarlet fever, and bacillary dysentery through the use of single or combined antigens. In 1927, these authors called attention to the chief benefits to be derived from the intranasal method of immunization, particularly with reference to diphtheria. These are simplicity of administration and absence of reactions. Thus, individuals that were strongly sensitive to diphtheria toxoid were immunized intranasally by Ramon with only a transient swelling of the nasal mucosa. The chill, fever, malaise and local inflammatory swelling that usually follow the injection of diphtheria toxoid into sensitive adults were conspicuously absent. Ramon's objection to intranasal immunization was its expense, due to the need of three courses of treatment, each consisting of two daily instillations repeated for eight days. Each nasal treatment was equivalent to 0.5 c.c. of Ramon's toxoid.

Although systemic reactions are rarely encountered after the injection of tetanus toxoid we can definitely state from our experience with subjects that have been immunized against tetanus by the combined subcutaneous and intranasal routes that the instillation of toxoid into the nose rather than its injection under the skin is preferred by both adults and children.

We are interested particularly in the use of a product for the "repeat dose" that will not require subcutaneous injection and which will result in the development of a tetanus antitoxin titer generally relied upon to protect an individual against tetanus.

A purified and concentrated tetanus toxoid (tetanus toxoid topagen) for topical application intranasally was supplied to us by the Mulford Biological Laboratories of Sharp and Dohme.* We have overcome Ramon's objection by the manner in which tetanus toxoid topagen is prepared and used as outlined in this report.

* Tetanus toxoid topagen was prepared from highly antigenic plain tetanus toxoid. The toxoid was then purified and concentrated to contain 25 Lf's per c.c. Animal tests performed on guinea pigs that had been previously injected with alum toxoid, showed that tetanus toxoid topagen administered intranasally served as an excellent secondary stimulus.

We have used tetanus toxoid topagen intranasally on 145 human beings. The method of administration is simple. The patient is placed on a table with the head in hyperextension. An ordinary glass dropper is then inserted in the nose, with the blunt end pointing toward the turbinates. About 0.10 c.c. (two or three drops) of the tetanus toxoid topagen is then squeezed out by pressure on the rubber bulb. The patient is asked to "snuff up" the drops, and the dropper is then removed and wiped with an alcohol sponge. This process of instillation is repeated in the other nares. The subject is kept in the recumbent position for two or three minutes and is told not to blow his nose for a few hours. As expected, this request was not complied with in every case. The intranasal instillations were repeated daily or weekly, two or three times, as indicated in the text.

No attempts were made to select any of the patients. Several received the tetanus toxoid topagen while suffering from acute coryza, when their noses were stuffy and filled with mucus. No irrigating solutions or vasoconstrictor drugs were used prior to the instillation. Many patients had deviated nasal septa which made the introduction of the dropper difficult, and in four individuals the obstruction was so marked that the drug had to be dropped in at the external opening of the nose.

About one-third of the treated subjects complained of burning in the nose immediately after instillation of the drops. This lasted two or three minutes. In some, there was lacrimation. Two non-allergic patients sneezed frequently for a few hours following treatment. In subjects suffering from hay fever or allergic coryza there was a definite increase in the severity of this local reaction which assumed the form of a "head cold" that cleared up overnight. There was no disability. A few subjects complained of an unpleasant taste when the tetanus toxoid topagen reached the throat but this sensation disappeared rather quickly. The local reaction which was undoubtedly partly due to the high glycerin content of the preparation did not interfere with completion of the course of instillations. No systemic reaction such as fever, malaise, urticaria or asthma was encountered. All patients preferred the nasal rather than the injection method of treatment.

Clinical Results. The 145 subjects undergoing treatment with tetanus toxoid topagen were divided into eight groups. Group A received tetanus toxoid topagen exclusively for the primary course of treatment. Groups B, C and D received one subcutaneous injection of alum precipitated tetanus toxoid and a series of intranasal instillations of tetanus toxoid topagen. Prior to nasal treatment Groups E, F, G and H were injected with two or more doses of alum precipitated toxoid or three or more doses of plain toxoid or toxoid (plain) with 0.4 per cent alum.

A control bleeding was obtained in each case just before the first tetanus toxoid topagen instillation. Thereafter, bleedings were taken at frequent intervals. The antitoxin titer of each sample of human blood serum was determined on guinea pigs in accordance with the standard technique of the National Institute of Health. As in previous communications we have in this report used 0.10 unit of antitoxin as the amount required to protect against clinical tetanus. This was arrived at from our studies on passive immunization against tetanus.[28] We realize that this base level of 0.10 unit may be too high, that is to say, less than 0.10 unit of tetanus antitoxin per c.c. of blood serum may be sufficient to protect man against infection with *Cl. tetani*. Yet until this question is definitely settled, we feel that it is safer to err on the side of conservatism.

Thirteen patients (Group A, Table 1) received two courses of tetanus toxoid topagen instillations. The first course consisted of three daily intranasal treatments (about 0.10 c.c. in each nostril). Ninety-two days later, eight patients received a second course of three daily instillations while five got two intranasal

treatments on successive days. In one instance the second course of treatment was given 106 days after the first, and it consisted of two nasal instillations given forty-eight hours apart.

The first course of intranasal instillations in Group A did not produce an appreciable increase in the antitoxin titer. Repeated titrations after completion of the second course of instillations showed less than 0.10 unit of antitoxin in all but three subjects. Case 222 showed more than 0.10 and less than 0.25 unit on the forty-seventh day, while Cases 223 and 303 had more than 0.10 and less than 0.25 unit and 0.25 unit respectively, on the fourteenth day. These last two patients displayed the same titer when retested on the forty-seventh and thirty-fourth days respectively.

Thirty-eight subjects (Groups B and C) were injected subcutaneously with the usual preparatory dose of 1.0 c.c. of tetanus toxoid alum precipitated. Ninety-one days later these individuals were treated intranasally with tetanus toxoid topagen (about 0.10 c.c. in each nostril). Twenty of them (Group B, Table II) received two daily treatments, while eighteen (Group C, Table III) received three such daily instillations.

In agreement with past findings, already reported,[6,28–31] the injection of the first dose of tetanus alum precipitated toxoid in these two groups failed to increase the titer to any appreciable extent. Seven days after intranasal treatment was instituted seventeen out of the twenty cases of Group B (Table II) showed less than 0.10 unit. The exceptions (421, 440, and 441) showed a definite increase in titer equal to or exceeding 0.10 unit. On the fourteenth day, all but one case showed 0.10 unit or more of tetanus antitoxin per c.c. of blood serum. The cases that responded to intranasal instillations of toxoid topagen showed antitoxin titers ranging from 0.10 unit to more than 1.0 and less than 3.0 units. The exception (430), when retested on the twenty-fifth day, showed more than 0.10 and less than 0.25 unit. The entire group was retested thirty-four days after nasal treatment was started. Nine cases showed no change, eight showed a decrease and three showed an increase over the previously recorded antitoxin titer. Actually, nineteen cases had 0.10 unit or more of antitoxin while one patient had less than 0.10 unit.

Thirteen out of eighteen patients in Group C (Table III) who received three daily instillations, showed less than 0.10 unit when tested seven days after the first nasal treatment. The other five cases showed an increase in titer that assured good protection against tetanus. On the fourteenth day, sixteen out of the seventeen cases that were tested, showed a titer of 0.10 unit or more of tetanus antitoxin per c.c. of serum. The highest value was recorded in Case 413 with more than 8.0 units. The exception, Case 437, had less than 0.10 unit, but when retested eleven days later he showed more than 0.10 unit and less than 0.25 unit. On the thirty-fourth day, seven members of the group showed a decrease, six showed no change and two showed an increase in titer over the previously recorded antitoxin values. At this time all but two patients had more than 0.10 unit.

Group D (Table IV) included seven individuals treated the same as Group C, except that the interval between the injection of toxoid and the course of nasal instillations was 119 to 155 days. Follow-up titrations revealed that seven days after the first instillation, four subjects had more than 0.10 unit of antitoxin while three still showed less than 0.10 unit. On the fourteenth day, two of the three subjects that were tested evinced a further increase in their antitoxin titer. Case 203 showed the poorest response with 0.10 unit on the twenty-first day, dropping to more than 0.02 and less than 0.10 unit of antitoxin when tested on the ninety-first day. Similarly, Case 206 showed a drop from 0.50 unit on the thirty-first day, to less than 0.10 unit on the ninety-fourth day, and Case 201 had less than 0.10 unit when

retested 182 days after the first instillation of tetanus toxoid topagen.

Two members of Group D (Table V) were given a "repeat" dose intranasally after the antitoxin content of the blood had nostril) 133 days after the first instillation. When tested two weeks later, both subjects showed more than 1.0 and less than 3.0 units. Their titers were well maintained upon retesting four to six weeks later.

TABLE I

GROUP A

First course of treatment: Three daily intranasal instillations of tetanus toxoid topagen #544A, 0.1 c.c. in each nostril. Second course of treatment: Two or three daily intranasal instillations of tetanus toxoid topagen #544A, 0.1 c.c. in each nostril. Interval between the two courses of treatment, 92 days. Titer expressed in units of tetanus antitoxin per c.c. of blood serum.

Case	Control Titer	Days after First Nasal Treatment (1st Course)		Number of Intranasal Installations (2nd Course)	Days after First Nasal Treatment (2nd Course)				
		Titer	Titer*		Titer				
		30 Days	92 Days		7 Days	9 Days	14 Days	34 Days	47 Days
220	−0.01	−0.01	0.01 −0.02	Three	−0.02	−0.10	−0.10		
222	−0.01	−0.01	+0.01 −0.02	Three	−0.02	−0.10	−0.10	.....	+0.10 −0.25
223	−0.01	−0.01	+0.01 −0.02	Three	−0.02	−0.10	+0.10 −0.25	.....	+0.10 −0.25
301	−0.01	−0.01	−0.10	Three	−0.10	.....	−0.10	−0.10	
304	−0.01	−0.01	−0.10	Three	−0.10	.....	−0.10	−0.10	
305	−0.01	−0.01	−0.10	Three	−0.10	.....	−0.10	−0.10	
308	−0.01	−0.01	−0.10	Three	−0.10	.....	−0.10	−0.10	
310	−0.01	−0.01	−0.10	Three	−0.10	.....	−0.10		
221	−0.01	−0.01	−0.01†	Two‡	−0.10	.....	.....	−0.10	
302	−0.01	−0.01	−0.10	Two	−0.10	.....	−0.10	−0.10	
303	−0.01	−0.01	−0.10	Two	−0.10	.....	0.25	0.25	
307	−0.01	−0.01	−0.10	Two	−0.10	.....	−0.10	−0.10	
309	−0.01	−0.01	−0.10	Two	−0.10	.....	−0.10	−0.10	

* Bleeding taken prior to first nasal instillation of second course of treatment.

† Bleeding taken 106 days.

‡ Second course of treatment consisted of two nasal instillations given 48 hours apart.

dropped to less than 0.10 unit. Case 203 got one such nasal instillation 161 days after the first tetanus toxoid topagen was administered, while Case 206 received two daily nasal treatments (0.10 c.c. in each

Group E consisted of twenty-eight individuals who received tetanus toxoid topagen intranasally on two successive days, as a "repeat" dose. (Table VI.) Prior to the intranasal administration of this

"repeat" dose, thirteen members of this group had been immunized with two injections of tetanus toxoid alum precipitated; eight had gotten three such injections; one subject had received two doses of alum toxoid and a third injection of plain toxoid; one patient had received five injections of alum toxoid; one had been injected with three doses of tetanus toxoid plus 0.4 per cent alum; two patients received four such doses, while two members had been

TABLE II

GROUP B

First course of treatment: 1.0 c.c. of tetanus toxoid alum precipitated refined #26542-1, injected subcutaneously. Second course of treatment: Two daily intranasal instillations of tetanus toxoid topogen #544A, 0.1 c.c. in each nostril. Interval between the two courses of treatment, 91 days. Titer expressed in units of tetanus antitoxin per c.c. of blood serum.

Case	Control Titer	Days after Injection of Toxoid		Days after First Nasal Treatment			
		Titer	Titer*	Titer			
		32 Days	91 Days	7 Days	14 Days	25 Days	34 Days
400	−0.01	−0.01	−0.10	−0.10	0.10	.....	0.10
402	−0.01	−0.01	−0.10	−0.10	0.25	.....	0.25
403	−0.01	.....	−0.10	−0.10	+0.50 −1.0	.....	+0.25 −0.50
406	−0.01	.....	−0.10	−0.10	+1.0	.....	+1.0
407	−0.01	−0.01	−0.10	−0.10	0.75	.....	+0.50 −0.75
409	−0.01	.....	−0.10	−0.10	0.10	.....	0.10
421	−0.01	.....	−0.10	0.25	1.0	.....	+0.50 −1.0
423	−0.01	.....	−0.10	−0.10	0.10	.....	0.10
424	−0.01	−0.01	−0.10	−0.10	1.5	.....	2.0
426	−0.01	−0.01	−0.10	−0.10	0.50	.....	0.75
428	−0.01	−0.01	−0.10	−0.10	1.5	.....	1.0
429	−0.01	−0.01	−0.10	−0.10	1.5	.....	1.5
430	−0.01	−0.01	−0.10	−0.10	−0.10	+0.10 −0.25	−0.10
432	−0.01	−0.01	−0.10	−0.10	0.10	.....	0.10
435	−0.01	−0.01	−0.10	−0.10	0.10	.....	0.25
438	−0.01	.....	−0.10	−0.10	0.75	.....	+0.50 −1.0
440	−0.01	−0.01	−0.10	+0.25 −0.50	1.5	.....	+0.50 −0.75
441	−0.01	−0.01	−0.10	0.10	+1.0 −3.0	.....	+1.0 −3.0
442	−0.01	−0.01	−0.10	−0.10	0.50	.....	0.50
443	−0.01	−0.01	−0.10	−0.10	0.50	+0.25 −0.50	0.25

* Bleeding obtained prior to first nasal instillation.

TABLE III

GROUP C

First course of treatment: 1.0 c.c. of tetanus toxoid alum precipitated refined #26542-1, injected subcutaneously. Second course of treatment: Three daily intranasal instillations of tetanus toxoid topagen #544A, 0.1 c.c. in each nostril. Interval between the two courses of treatment, 91 days. Titer expressed in units of tetanus antitoxin per c.c. of blood serum.

Case	Control Titer	Days after Injection of Toxoid		Days after First Nasal Treatment			
		Titer	Titer*	Titer			
		32 Days	91 Days	7 Days	14 Days	25 Days	34 Days
401	−0.01	−0.01	−0.10	−0.10	0.25	.....	+0.10 −0.25
404	−0.01	−0.01	−0.10	0.50	+5.0 −7.5	.....	+1.0 −3.0
405	−0.01	.....	−0.10	−0.10	0.10	.....	−0.10
408	−0.01	−0.01	−0.10	−0.10	1.5		
410	−0.01	.....	−0.10	−0.10	0.10	.....	+0.10 −0.25
411	−0.01	.....	−0.10	0.50	1.0	.....	+0.50 −1.0
413	−0.01	.....	−0.10	+1.0 −3.0	+8.0	.....	+9.0 −10.0
414	−0.01	−0.01	−0.10	−0.10	1.0	.....	+0.25 −0.50
415	−0.01	.....	−0.10	−0.10	1.0	.....	+1.0 −3.0
416	−0.01	.....	−0.10	+0.10 −0.25	+1.0 −3.0	.....	+1.0 −3.0
417	−0.01	−0.01	−0.10	−0.10	.....	.....	+0.10 −0.25
419	−0.01	−0.01	−0.10	−0.10	0.50	.....	+0.25 −0.50
420	−0.01	−0.01	−0.10	−0.10	1.0	.....	1.0
427	−0.01	−0.01	−0.10	0.10	1.5	.....	1.5
431	−0.01	−0.01	−0.10	−0.10	1.0	.....	1.0
434	−0.01	−0.01	−0.10	−0.10	0.5	.....	0.5
437	−0.01	.....	−0.10	−0.10	−0.10	+0.10 −0.25	−0.10
439	−0.01	−0.01	−0.10	−0.10	+0.10 −0.25	.....	+0.10 −0.25

* Bleeding obtained prior to first nasal instillation.

injected with four doses of plain tetanus toxoid. The time interval that elapsed between the last injection of toxoid and the first intranasal application of tetanus toxoid topagen is indicated in Table VI. Eight subjects had a control titer of less than 0.10 unit per c.c. of blood serum while the rest had 0.10 unit or more.

0.10 unit or more per c.c. of blood serum. Case 9951 actually had 5.0 units. Six patients showed the same antitoxin content as before intranasal stimulation. Two additional cases showed less than 0.10 unit but one of them, when tested for lower values showed some increase, though not sufficient to reach the 0.10 unit level. Of fourteen

TABLE IV

GROUP D

First course of treatment: 1.0 c.c. of tetanus toxoid alum precipitated refined, injected subcutaneously. Second course of treatment: Three daily intranasal instillations of tetanus toxoid topagen #544A, 0.1 c.c. in each nostril. Interval between the two courses of treatment, 119–155 days. Titer expressed in units of tetanus antitoxin per c.c. of blood serum.

Case	Days after Toxoid Injection	Days after First Nasal Treatment							
	Titer*	Titer							
200	119 days −0.10	.....	7 days +0.10 −0.25						
201	119 days −0.10	.....	7 days +0.10 −0.25	.....	.....	35 days 0.50	.....	105 days +0.10 −0.25	182 days −0.10
202	119 days −0.10	.....	7 days +1.0 −3.0	14 days +1.0 −3.0	.....	32 days 3.0	.....	91 days +1.0 −3.0	182 days 1.0
203	119 days −0.10	5 days −0.10	7 days −0.02	.....	21 days 0.10	35 days +0.10 −0.25	49 days +0.10 −0.25	91 days +0.02 −0.10	161 days +0.01 −0.10
204	119 days −0.10	.....	7 days +0.25 −0.50	14 days +1.0 −3.0	.....	32 days 0.50	.....	91 days +0.10 −0.25	192 days 0.10
206	155 days −0.02	.....	7 days 0.02	17 days +0.50 −1.0	.....	31 days 0.50	.....	94 days −0.10	133 days −0.10
207	154 days −0.02	.....	7 days 0.05	.....	28 days +0.25 −0.50	.....	.....	98 days +0.10 −0.25	

* Bleeding obtained prior to first nasal instillation.

Five days after the first tetanus toxoid topagen instillation, one out of ten tested showed an increase in titer from less than 0.10 to 0.10 unit. The rest had the same values as in the control tests. On the seventh day after the first instillation eighteen out of twenty-six showed a definite increase in titer. Those who had a control value of less than 0.10 unit showed

patients retested two days later, two showed no change in titer, while the rest displayed a marked increase. On the fourteenth day following the first instillation, the entire group with the exception of one patient, and four not tested, showed a further increase in titer, ranging from more than 0.25 to less than 12.0 units, an increase of from 2.5 to over 100 times the

control antitoxin values. The exception, case 9962, showed no increase over the titer obtained on the ninth day (0.25 unit).

When retested four to six weeks after intranasal stimulation was started, eight individuals showed no change from the previously recorded titer, eight showed an increase, while seven displayed a decrease. All patients had good antitoxic immunity. The values ranged from more

Table V
GROUP D

First course of treatment: 1.0 c.c. of tetanus toxoid alum precipitated refined, injected subcutaneously. Second course of treatment: Three daily intranasal instillations of tetanus toxoid topagen #544A, 0.1 c.c. in each nostril. Third course of treatment: "Repeat stimulus" tetanus toxoid topagen #544A, 0.1 c.c. in each nostril. Titer expressed in units of tetanus antitoxin per c.c. of blood serum.

Case	Days between 1st and 2nd Course of Intranasal Instillation	Number of Intranasal Instillations, 2nd Course ("Repeat Stimulus")	Control Titer*	Days after First Nasal Treatment (Second Course "Repeat Stimulus")	
				Titer	
203	161	One	+0.01 −0.10	14 days +1.0 −3.0	42 days +0.50 −1.0
206	133	Two (successive days)	−0.10	13 days +1.0 −3.0	31 days 1.0

* Bleeding obtained prior to first nasal instillation of second course ("repeat stimulus").

than 0.25 unit to 10 units per c.c. of blood serum.

Of twenty-five patients retested ninety-one to ninety-five days after nasal stimulation was initiated, seventeen showed a decrease, six showed the same and only two showed an increase over the previously recorded titer. In a few patients the loss in titer was marked, but in all cases the antitoxin values were still greater than those found before immunization, indicating good protection. Case 8096 had less than 0.10 unit when tested 114 days after the first topagen application. Case 7966 showed 0.10 unit when tested on the 144th day. Cases 210, 9915 and 9919 still showed good protection when tested six months after nasal stimulation.

As a "repeat stimulus" tetanus toxoid was given intranasally on three successive days to a group of twenty-nine subjects. (Group F, Table VII.) Prior to this nasal stimulation, twelve of these patients had been immunized with two injections of tetanus toxoid alum precipitated; ten had received three such injections; one had received four doses of alum precipitated tetanus toxoid; two had been injected with three doses of tetanus toxoid plus 0.4 per cent alum; two had three injections of plain tetanus toxoid while the remaining two members of group G had received four doses of plain toxoid. The interval of time that elapsed between the last injection of toxoid and the first intranasal application of tetanus toxoid topagen is indicated in Table VII.

Sixteen cases had a control titer of less than 0.10 unit per c.c. blood serum, while the rest had 0.10 unit or more of antitoxin. Five days after the first instillation seven patients were tested and only one showed an increase from less than 0.10 to 0.10 unit. On the following day (sixth day) two cases showed an increase in titer to and above 0.10 unit, while two others showed no change over the control values. The latter, however, showed an increase in titer when retested three days later. On the seventh day, twenty out of twenty-four cases that were tested showed a definite increase in titer to or above the 0.10 unit or control titer. Of the remaining four, three showed no increase above the control values. However, when retested two days later, the latter showed a marked increase in titer. The fourth case showed an increase of low magnitude, from 0.02 to 0.05 unit. When retested on the fourteenth day, this patient had 0.25 unit. Twenty-two patients were tested on the ninth day, and they each had an excellent antitoxin response. A further increase in titer was found on the fourteenth day; most patients had more than 1.0 unit. At the end of a month, the antitoxin titer was the same in thirteen cases, was increased in eleven and was reduced in four patients. Retests done on

TABLE VI

GROUP E

Two daily intranasal instillations of tetanus toxoid topagen #544A, 0.1 c.c. in each nostril, given as a "repeat dose." Titer expressed in units of tetanus antitoxin per c.c. of blood serum.

Patient	Interval between Last Toxoid Injection and First Nasal Instillation, Days	Titer before Nasal Instillation	Days after First Nasal Instillation — Titer								
			5 Days	7 Days	9 Days	14 Days	30–31 Days	91–95 Days	128 Days	144 Days	182–196 Days
101**	657	−0.10	−0.10	0.10	.....	+ 0.25 − 0.50	+ 0.50 − 1.0	0.50			
103**	657	−0.10	−0.10	+0.25 −0.50	.....	+ 1.0 − 3.0	+ 1.0 − 3.0	+2.0 −3.0			
139**	657	−0.10	−0.10	0.50	.....	+ 8.0 −10.0	8.0	5.0			
9951**	902	−0.10	0.10	5.0	.....	+10.0 −12.0	10.0	7.0			
102**	657	−0.10	−0.10	−0.10	.....	+ 0.25 − 0.50	0.50	+0.25 −0.50			
124**	657	+0.02 −0.05	−0.10	+0.05 −0.10	.....	+ 0.50 − 1.0	+ 1.0 − 3.0	+0.50 −1.0			
119**	657	0.10	0.10	+0.10 −0.25	.....	+ 1.0 − 3.0	+ 3.0 − 5.0	+3.0 −5.0			
210**	949	+0.10 −0.25	+0.10 −0.25	.....	.....	+ 0.50 − 1.0	32 days 5.0	+1.0 −2.0	.....	....	+0.50 −1.0
123**	678	0.10	.....	+0.25 −0.50	3.0	+ 7.5 −10.0	7.0	+1.0 −3.0			
132**	678	+0.10 −0.25	.....	0.50	+1.0 −3.0	3.0	+ 1.5 − 2.0	+1.0 −2.0			
110**	678	0.25	.....	+0.25 −0.50	1.0	+ 1.5 − 3.0	+ 1.5 − 3.0	3.0			
9926**	923	+0.10 −0.25	.....	+0.25 −0.50	+1.0 −3.0	3.0	+ 1.0 − 3.0	+1.0 −3.0			
10013**	801	0.10	.....	+0.10 −0.25	0.50	+ 0.50 − 1.0	+ 0.75 − 1.0	1.0			
7966***	994	−0.10	.....	0.50	.....	.....	28 days + 1.0 − 3.0	0.25	.....	0.10	
8096***	592	−0.10	.....	0.10	10 days +0.10 −0.25	.....	38 days 0.25	114 days +0.05 −0.10			
9915***	525	0.10	0.10	+0.10 −0.25	.....	.....	35 days 0.50	0.25	.....	....	+0.10 −0.25
9906***	546	+0.50 −1.0	.....	.....	.....	5.0	42 days 5.0	3.0			
9919**‡	475	+1.0 −3.0	+1.0 −3.0	+1.0 −3.0	.....	.....	42 days + 3.0 − 5.0	3.0	.....	....	3.0
500*****	559	0.10	.....	+0.10 −0.25	.....	+ 1.0 − 3.0	35 days + 1.0				
9943***	651	0.25	.....	+0.25 −0.50	3.0	+ 7.0 −10.0	6.0	+0.50 −1.0			
9955***	651	0.10	.....	+0.10 −0.25	+0.50 −0.75	+ 2.0 − 3.0	+ 2.0 − 3.0	+2.0 −3.0			
9953***	651	+0.10 −0.25	.....	+0.25 −0.50	+1.0 −3.0	3.0	+ 1.0 − 3.0	.....	+0.50 −1.0		
9931***	564	+0.25 −0.50	.....	+0.25 −0.50	+0.25 −0.50	+ 0.50 − 1.0	+ 0.50 − 1.0	+0.50 −0.75			
9978††††	564	+0.10 −0.25	.....	+0.10 −0.25	+0.10 −0.25	+ 0.25 − 0.50	0.50	0.25			
9983††††	564	+0.25 −0.50	.....	+0.25 −0.50	+0.50 −1.0	+ 0.75 − 1.0	1.0	+0.50 −1.0			
9976†††	934	0.50	.....	+0.50 −1.0	1.0	+ 1.5 − 3.0	+ 1.0 − 2.0	+0.50 −1.0			
9962‡‡‡‡	564	+0.10 −0.25	.....	+0.10 −0.25	0.25	0.25	+ 0.25 − 0.50	+0.10 −0.25			
9963‡‡‡‡	564	0.50	.....	0.50	+0.50 −0.75	+ 1.0 − 3.0	+ 1.0 − 3.0	+0.50 −1.0			

* One injection of tetanus toxoid, alum precipitated received prior to nasal instillation.
† One injection of tetanus toxoid, plus 0.4 per cent alum received prior to nasal instillation
‡ One injection of tetanus toxoid, plain received prior to nasal instillation.

TABLE VII

GROUP F

Three daily intranasal instillations of tetanus toxoid topagen #544A, 0.1 c.c. in each nostril, given as a "repeat dose." Titer expressed in units of tetanus antitoxin per c.c. of blood serum.

Patient	Interval between Last Toxoid Injection and First Nasal Instillation, Days	Titer before Nasal Instillation	Days after First Nasal Instillation — Titer								
			5 Days	6 Days	7 Days	9 Days	14 Days	30–34 Days	90–94 Days	128 Days	184–189 Days
100**	67	−0.10	−0.10	.....	0.25	.....	+1.0 −3.0	+ 1.0 − 3.0	2.0		
112**	657	−0.10	−0.10	.....	+0.25 −0.50	.....	+1.0 −3.0	+ 1.0 − 3.0	2.0		
121**	657	−0.10	−0.10	.....	+0.10 −0.25	.....	+1.0 −3.0	+ 1.0 − 3.0	+0.50 −1.0		
136**	657	−0.10	−0.10	.....	0.10	.....	1.0	1.0	+0.50 −1.0		
131**	609	−0.10	.....	0.10	.....	+0.50 −1.0	.....	+ 1.0 − 3.0	+1.0 −3.0	.....	+3.0 −4.0
134**	609	−0.10	.....	+0.10 −0.25	.....	+1.0 −3.0	.....	+ 3.0 − 5.0	+0.50 −1.0	.....	+0.25 −0.50
9949**	854	−0.10	.....	.....	0.50	+1.0 −3.0	.....	+ 5.0 −10.0	5.0	.....	+1.0 −3.0
10007**	732	−0.10	.....	−0.10	.....	+0.25 −0.50	.....	0.50	0.50	.....	0.50
104**	657	0.02	−0.10	.....	0.05	.....	0.25	+ 0.25 − 0.50	+0.25 −0.50		
125**	609	0.10	.....	0.10	.....	+0.10 −0.25	.....	+ 0.25 − 0.50	+0.25 −0.50	.....	+0.10 −0.25
115**	678	0.50	.....	.....	+0.50 −1.0	+0.75 −1.0	+1.0 −3.0	+ 1.0 − 3.0	.....	+0.50 −1.0	
117**	678	0.25	.....	.....	0.50	+1.0 −3.0	+5.0 −7.5	5.0	+1.0 −3.0		
9946***	630	−0.10	0.10	.....	+0.10 −0.25	.....	+0.50 −1.0	1.0	0.50		
10002***	582	−0.10	.....	.....	+0.10 −0.25	0.25	.....	0.25	+0.10 −0.25	.....	0.10
9944***	582	−0.10	.....	.....	.....	1.0	.....	+ 1.0 − 3.0	+1.0 −3.0	.....	+0.50 −1.0
9939***	651	0.10	.....	.....	0.25	+0.50 −1.0	+1.0 −3.0	+ 1.0 − 3.0	+0.50 −1.0		
9948***	651	+0.25 −0.50	.....	.....	+0.50 −1.0	+1.0 −3.0	+1.5 −3.0	2.0	+1.0 −2.0		
9933***	651	0.25	.....	.....	+1.0 −3.0	6.0	6.0	+ 3.0 − 5.0	+1.0 −3.0		
9928***	564	+0.25 −0.50	.....	.....	+1.0 −3.0	5.0	5.0	+ 3.0 − 5.0	+1.0 −3.0		
10012***	564	0.25	.....	.....	+0.25 −0.50	1.0	6.0	+ 3.0 − 5.0	1.0		
9942***	651	+0.25 −0.50	.....	.....	+0.25 −0.50	0.50	+1.0 −3.0	+ 1.5 − 3.0	+1.0 −2.0		
9941***	651	0.25	.....	.....	0.25	1.0	+1.5 −3.0	+ 2.0 − 3.0	+1.0 −2.5		
7756****	959	−0.10	−0.10	.....	+0.25 −1.0	.....	+3.0 −5.0	+ 3.0 − 5.0	3.0	.....	+1.0 −3.0
9982†††	948	−0.10	.....	.....	0.10	+0.50 −1.0	+1.0 −3.0	+ 1.0 − 3.0	1.0		
9973†††	878	−0.10	.....	.....	+0.25 −0.50	1.0	.....	+ 3.0 − 5.0	3.0	.....	1.5
9964‡‡‡	865	−0.10	.....	.....	+0.50 −1.0	+1.0 −3.0	.....	+ 5.0 −10.0	5.0	.....	+0.50 −1.0
9970‡‡‡	879	0.25	.....	.....	+0.50 −1.0	0.50	.....	+ 1.0 − 3.0	+1.0 −3.0	.....	1.0
9986‡‡‡‡	564	+0.10 −0.25	.....	.....	0.25	0.50	+0.25 −0.50	+ 0.25 − 0.50	0.25		
9968‡‡‡‡	564	+0.25 −0.50	.....	.....	+0.25 −0.50	+0.50 −1.0	+1.0 −3.0	+ 1.0 − 3.0	+0.50 −1.0		

* One injection of tetanus toxoid, alum precipitated received prior to nasal instillation.
† One injection of tetanus toxoid, plus 0.4 per cent alum received prior to nasal instillation.
‡ One injection of tetanus toxoid, plain received prior to nasal instillation.

twenty-eight patients ninety to ninety-four days after the initial nasal instillation, showed a decrease in titer in eighteen cases. Notwithstanding this loss in antitoxin, their titers were still far above the control values, assuring protection against tetanus. Case 115 showed more than 0.50 and less than 1.0 unit when tested 128 days after nasal stimulation. Eleven were retested six months after the first instillation of tetanus toxoid topagen and they all had more than 0.10 unit. Five of these patients actually had 1.0 unit or more of antitoxin per c.c. of blood serum.

Group G (Table VIII) consisted of twenty-one individuals who received two intranasal applications of tetanus toxoid topagen, a week apart. Prior to this stimulation, eleven patients had been immunized with two injections of alum precipitated tetanus toxoid; seven had received three such injections; one had three doses of tetanus toxoid plus 0.4 per cent alum, and two patients had received four doses of the latter antigen. The time interval that elapsed between the last injection of toxoid and the first intranasal instillation is indicated in Table VIII.

Before application of the tetanus toxoid topagen nine patients had less than 0.10 unit of tetanus antitoxin per c.c. of blood serum. The other twelve had 0.10 unit or more. Five days after the first intranasal instillation, two showed an increase in titer from less than 0.10 to 0.10 unit while six had less than 0.10 unit. The entire group was bled seven days after a single nasal application, just before the second instillation. The sera of ten showed a definite increase in titer above the control values, more than sufficient to afford protection. Two additional patients showed an increase from a control titer of 0.05 unit to more than 0.05, but less than 0.10 unit. Nine subjects showed no change in titer. In three of these the titer remained less than 0.10 unit.

Two days after the second nasal instillation of tetanus toxoid topagen, eleven out of thirteen subjects tested showed a further definite increase in titer, ranging from 0.10 to 12.5 units per c.c. of blood serum., while two showed the same titers as in the control test. However, when retested on the seventh day after the second intranasal application (fourteenth day after the initial application), these two patients showed a decided jump in antitoxin titer, and the entire group displayed an increase ranging from more than 0.25 to more than 20.0 units.

This remarkable antitoxin response was maintained in six subjects, was further increased in ten and was somewhat decreased in five members of the group at a retest a month after the first tetanus toxoid topagen instillation. The highest value we have ever encountered since we began active immunization of human beings against tetanus, was shown by Case 9937 with 30.0 units of antitoxin per c.c. of blood serum. A loss in titer was noted in all but three cases when the group was retested ninety-three to ninety-four days after intranasal stimulation. Yet notwithstanding this decrease in titer, the antitoxin values ranged from 0.25 to more than 15.0 and less than 20.0 units, an increase in several cases of sixty to 150 times over the control titer.

Group H (Table IX) consisted of nine patients who received three weekly intranasal instillations of tetanus toxoid topagen. Before nasal treatment was instituted, four had been injected with two doses of alum precipitated toxoid, one with three such doses, two with three doses of toxoid plus 0.4 per cent alum and two with three injections of plain toxoid. The interval that elapsed between the last toxoid injection and the first intranasal instillation is indicated in Table IX. Before treatment with tetanus toxoid topagen each patient had less than 0.10 unit of antitoxin per c.c. of blood serum. Seven days after the first and just before the second instillation five patients were bled and their sera titrated. Three showed an increase in titer to or above 0.10 unit, while the other two showed the same values as in the control tests.

TABLE VIII

GROUP G

Two weekly intranasal instillations of Tetanus toxoid topagen #544A, 0.1 c.c. in each nostril, given as a "repeat dose." Titer expressed in units of tetanus antitoxin per c.c. of blood serum.

Patient	Interval between Last Toxoid Injection and First Nasal Instillation, Days	Titer before Nasal Instillation	Days after First Nasal Instillation — Titer					
			5 Days	7 Days	9 Days	14 Days	30–31 Days	93–94 Days
105**	657	−0.10	0.10	+0.25 −0.50	.....	+3.0 −5.0	+5.0 −10.0	+6.0 −7.5
107**	657	−0.10	0.10	+0.10 −0.25	.....	+1.0 −3.0	+3.0 −4.0	3.0
113**	657	−0.10	−0.10	+0.50 −3.0	.....	+3.0 −5.0	+3.0 −5.0	+3.0 −3.5
137**	657	−0.10	−0.10	0.10	.....	+5.0 −8.0	+5.0 −8.0	3.0
109**	657	0.05	−0.10	+0.05 −0.10	.....	+0.25 −0.50	0.50	+0.25 −0.50
116**	657	0.02	−0.10	0.02	.....	+1.0 −3.0	+5.0 −6.0	3.0
127**	657	−0.10	−0.10	−0.10	.....	+0.50 −1.0	1.0	0.75
120**	678	+0.25 −0.50	.....	+0.25 −0.50	1.0	+1.0 −3.0	2.0	+1.0 −2.0
126**	678	+0.10 −0.25	.....	+0.10 −0.25	0.25	+1.0 −3.0	+1.0 −3.0	+1.0 −1.5
10,006**	801	0.25	.....	+0.25 −0.50	+1.0 −3.0	15.0	11.0	+5.0 −7.5
9937**	923	0.25	.....	3.0	12.5	+20.0	30.0	+15.0 −20.0
9947***	630	−0.10	−0.10	−0.10	.....	+0.50 −1.0	1.0	0.50
9925***	651	+0.25 −0.50	.....	+0.50 −0.75	0.75	3.0	+1.0 −3.0	1.0
9954***	651	+0.50 −1.0	.....	1.0	+1.5 −3.0	2.0	+1.0 −2.0	+1.0 −2.0
9932***	564	0.25	.....	+0.50 −1.0	+1.0 −3.0	3.0	+1.0 −3.0	+0.50 −1.0
10,004***	564	+0.50 −0.75	.....	+0.50 −0.75	0.75	+1.0 −3.0	+1.0 −3.0	+1.0 −1.5
10,005***	564	0.10	.....	0.10	0.10	+0.25 −0.50	+0.25 −0.50	0.25
10,008***	564	0.10	.....	+0.10 −0.25	0.50	+3.0 −5.0	1.5	+0.25 −0.50
9979†††	934	+0.10 −0.25	.....	+0.10 −0.25	+0.10 −0.25	+0.50 −1.0	+1.0 −3.0	+1.0 −3.0
9975††††	564	0.05	.....	+0.05 −0.10	0.10	+0.50 −1.0	1.0	+0.50 −1.0
9985††††	564	0.10	.....	0.10	+0.10 −0.25	+0.25 −0.50	0.50	+0.25 −0.50

* One injection of tetanus toxoid, alum precipitated received prior to nasal instillation.
† One injection of tetanus toxoid, plus 0.4 per cent alum received prior to nasal instillation.

Seven days after the second (fourteenth day after the first application) and just before the third instillation, the entire group was bled. Their sera showed an increase in titer that ranged from more than 0.25 to 8.0 units. A week after the third instillation five cases showed a further increase while four showed the same antitoxin values. All cases but one showed a decrease in titer ninety days after the initial intranasal stimulation. The titers of the group ranged from 0.50 to more than 3.0 and less than 5.0 units. Case 122 showed no change from the previous test. When retested 184 days after intranasal stimulation, all cases except two showed a further reduction in their titers which were, however, well above the control values, assuring protection against tetanus.

TABLE IX

GROUP H

Three weekly intranasal instillations of tetanus toxoid topagen #544A, 0.1 c.c. in each nostril, given as a "repeat dose." Titer expressed in units of tetanus antitoxin per c.c. of blood serum.

Patient	Interval between Last Toxoid Injection and First Nasal Instillation, Days	Titer before Nasal Instillation	Days after First Nasal Instillation — Titer				
			7 Days	14 Days	21 Days	90 Days	184 Days
122**	609	−0.10	.....	+1.0	+1.0 −3.0	+1.0 −3.0	+0.25 −0.50
130**	609	−0.10	.....	+3.0 −3.5	3.0	+0.50 −1.0	+0.25 −0.50
135**	609	−0.10	0.10	2.0	2.0	+0.50 −1.0	+0.25 −0.50
9936**	854	−0.10	+0.50 −1.0	8.0	8.0	+3.0 −5.0	+1.0 −3.0
9945***	582	+0.50 −0.10	+0.50 −0.10	+1.0 −3.0	+3.0 −5.0	1.0	+0.25 −0.50
9984†††	879	+0.05 −0.10	+0.05 −0.10	+0.25 −0.50	+0.50 −1.0	+0.50 −1.0	+0.50 −1.0
9981†††	879	−0.10	.....	+0.50 −1.0	+3.0 −5.0	0.50	+0.25 −0.50
9969‡‡‡	851	−0.10	.....	+0.25 −0.50	+0.50 −1.0	0.50	0.50
9960‡‡‡	865	−0.10	0.10	+2.0 −3.0	+5.0 −8.0	+1.0 −3.0	+0.50 −1.0

* One injection of tetanus toxoid alum precipitated received prior to nasal instillation.

† One injection of tetanus toxoid plus 0.4 per cent alum received prior to nasal instillation.

‡ One injection of tetanus toxoid plain received prior to nasal instillation.

DISCUSSION

An analysis of the results obtained in our Groups A, B, and C (Table I, II and III) reveals the importance of the rôle played by the first subcutaneous injection of alum toxoid. Within the limits of dosage and schedule used by us it is apparent from the results obtained in our Group A that the subcutaneous dose cannot be uniformly replaced by three daily intranasal instillations of tetanus toxoid topagen. It would appear that in order to render the antitoxin-producing cells of the body capable of responding to subsequent stimulation by intranasally administered toxoid, it is necessary to introduce within the host a definite amount of toxoid. This did not take place in our Group A. We do not know whether this is due to differences in the amounts absorbed through the nasopharyngeal mucosa as compared to the quantity deposited under the skin, or whether a qualitative factor inherent to the different portals of entry of the toxoid is responsible for it. Experiments are now under way to rule out the first possibility. However, regardless of cause, we may conclude that all subjects must first receive a dose of alum toxoid subcutaneously in order that they may be able to react to subsequent stimulation through the mucous membrane of the nose.

A comparison of Tables II and III reveals the fact that a greater number of subjects reached the 0.10 unit level of antitoxin earlier in Group C, which received three daily instillations than in Group B which received two daily instillations, and that the magnitude of the antitoxin response was greater in Group C. On the other hand, at the end of thirty days, two members of Group C dropped below the 0.10 unit level, while only one patient in Group B showed at this time less than 0.10 unit. However, since a small number of individuals were involved, we must consider these findings as suggestive only.

It is interesting to compare the results obtained in Groups B, C and D (Table II, III and IV) with the titer that develops after the subcutaneous injection of a second dose of tetanus alum precipitated toxoid, as reported in previous communications.[6,30,33] In the latter, we find that out of twenty-four subjects that were tested seven days after the second injection of alum toxoid, six showed less than 0.10 unit, while the rest had 0.10 unit or more of antitoxin per c.c. of blood serum. On the fourteenth or fifteenth day, twenty-six subjects were tested and all had 0.10 unit or more of antitoxin, indicating good protection. Forty-five subjects that were tested one month after the second injection of toxoid showed more than 0.10 unit of antitoxin. (We have excluded one individual who was refractory to two injections of toxoid.) These differences are well illustrated in Chart I. It would therefore appear that the antitoxin protection produced by intranasal tetanus toxoid topagen develops less promptly and is not so lasting as that which follows the injection of a second dose of tetanus alum precipitated toxoid.

Table V brings out the effective response obtained by the use of tetanus toxoid topagen intranasally as a "repeat" dose in two patients who had received the basic course of immunization by the combined subcutaneous and intranasal routes.

In the remaining groups of subjects reported in this paper (Tables VI, VII, VIII and IX) we are concerned with the value of tetanus toxoid topagen given intranasally in lieu of a "repeat" injection of tetanus toxoid alum precipitated. The eighty-seven subjects included had developed a substantial immunity as the result of the previous injection of two or more doses of tetanus toxoid.

A comparative study of our results indicates that at the end of one week after the first instillation of tetanus toxoid topagen, ten members of Group G (Table VIII) which, by this time, had received only one nasal application, showed an increase in titer above that of the control test, while fourteen subjects showed no increase over the control values or still had less than 0.10 unit of antitoxin. Two additional subjects showed an increase over the control titer but not sufficient to reach the 0.10 unit level. On the other hand, in Group E (Table VI) which had received two nasal instillations on successive days, eighteen individuals showed an increase over the control titer, while seven showed the same values as in the control bleeding. One subject showed an increase, but not sufficient to reach 0.10 unit. In Group E (Table VII) which had received three nasal applications of tetanus toxoid topagen on successive days, twenty-two subjects showed an increase over the control values, while four showed either no increase or had less than 0.10 unit. These results hold true, even when these three groups of subjects are further subdivided in accordance with (1) the number of injections received prior to stimulation by tetanus toxoid topagen, or (2) whether the level of antitoxin prior to intranasal instillation was above or below 0.10 unit. In Groups E and F about the same number of individuals showed a further increase in titer between the seventh and ninth day after the first tetanus toxoid topagen instillation. In Group G, following the administration of the second intranasal dose, there was a definite increase in the number of individuals that showed a rise in titer two days later. At the end of two weeks, there was no great difference between the three groups, judging by the number of individuals that showed a rise in titer.

Analyzed from another angle, the findings show that on the ninth day after the first nasal instillation, two subjects in Groups E and G failed to show any increase over the control titer, while in Group F all subjects showed an increase. Naturally in Group G this may have been due to the short interval that elapsed between the second tetanus toxoid topagen instillation and the time of testing.

These findings would seem to indicate that three nasal instillations of tetanus toxoid topagen on successive days produce a more rapid rise in antitoxin titer than do two daily or two weekly instillations. Group H (Table IX), which received three weekly nasal applications of toxoid, did not show better immediate results than Group G. (Table VIII.)

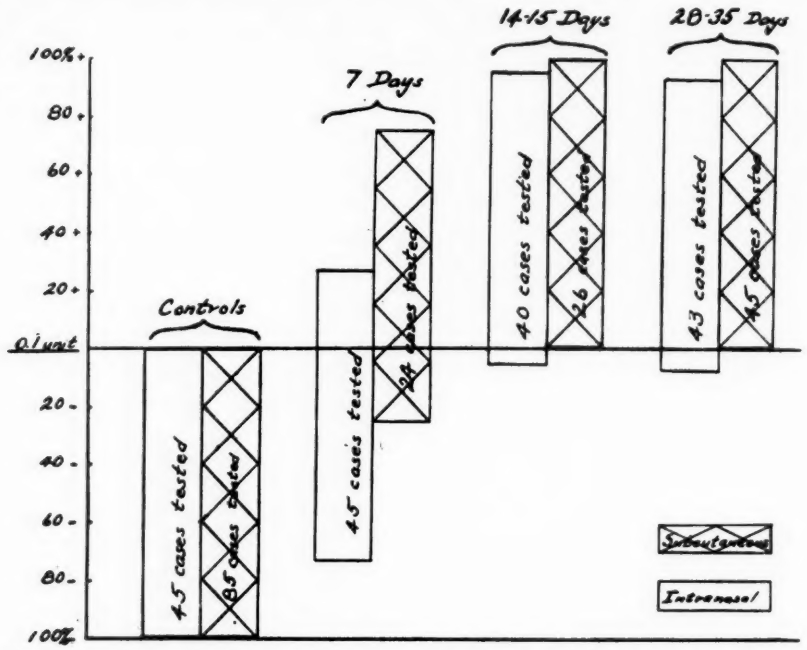


CHART 1. Comparison of the percentage of patients showing at least 0.10 unit of tetanus antitoxin following completion of the primary course of immunization in two groups of patients. One received two subcutaneous injections of alum precipitated toxoid while the other group received one subcutaneous injection of alum toxoid and a series of nasal instillations of tetanus toxoid topagen.

Little can be said about differences in the level of antitoxin titer present in these groups. Individual variability in response is so marked that no comparisons can be made.

There did not appear to be any gross difference in the response elicited when the tetanus toxoid topagen was administered to subjects who had been previously immunized with two doses of toxoid as compared with those who had received from three to five toxoid injections. But regardless of the influence exerted by these factors, we do know that at the end of two to four weeks, all subjects were in possession of a large amount of tetanus antitoxin. Thus, in Case 10002 (Table VII), who showed the poorest response of all the individuals under study, the titer was equivalent to that obtained after the subcutaneous injection of about 3000 units of tetanus antitoxin. In Case 9937 (Table VIII) who showed the highest titer, it was equivalent to the titer produced by the subcutaneous injection of about 450,000 units of tetanus antitoxin.

At the end of three months all the patients under consideration with the exception of Case 9962 (Table VI) had an antitoxin titer well above the control value, although in many it was not so high as at the end of thirty days. Twenty-three members of Groups E, F and H (Tables VI, VII and IX) showed good protection when tested six months after the "repeat" nasal stimulation.

A comparison of the antitoxin titer obtained after "repeat" stimulation by intranasal tetanus toxoid topagen with that produced by the subcutaneous injection of 1.0 c.c. of tetanus toxoid alum precipi-

tated in subjects that had received a basic course of immunization (two injections of alum toxoid, ninety days apart)[32] reveals the fact that in the latter the response is more prompt and the titer reaches a higher level earlier than when intranasal toxoid is used. Thus, after a "repeat" toxoid injection, the antitoxin titer reaches the 0.10 unit level in five to seven days, while after three daily nasal instillations given as a "repeat" dose it may take seven to nine days. Also the average titer at the end of a week after a repeat stimulus is administered is higher after a toxoid injection. However, after fourteen to thirty days, there is no gross difference in the height of antitoxic immunity present in the two groups. In some of the subjects that had received a third injection of toxoid prior to intranasal stimulation with tetanus toxoid topagen, the titer produced by the latter was not so high as that which followed the toxoid injection.[30,31,32] This may have been due not so much to the difference in the method of administration of the toxoid as to the state of antitoxic immunity present at the time of stimulation. Differences in the time interval that separated the administration of the various stimulating doses of toxoid must also be considered. In some subjects, such as Case 8096, who was an allergic individual, the poorer response after intranasal toxoid was no doubt due to poor absorption through the nasal mucosa as a result of the local reaction that ensued. In this type of individual it may perhaps be worth while to increase the number of instillations. Typical responses to intranasal stimulation are illustrated in Chart II.

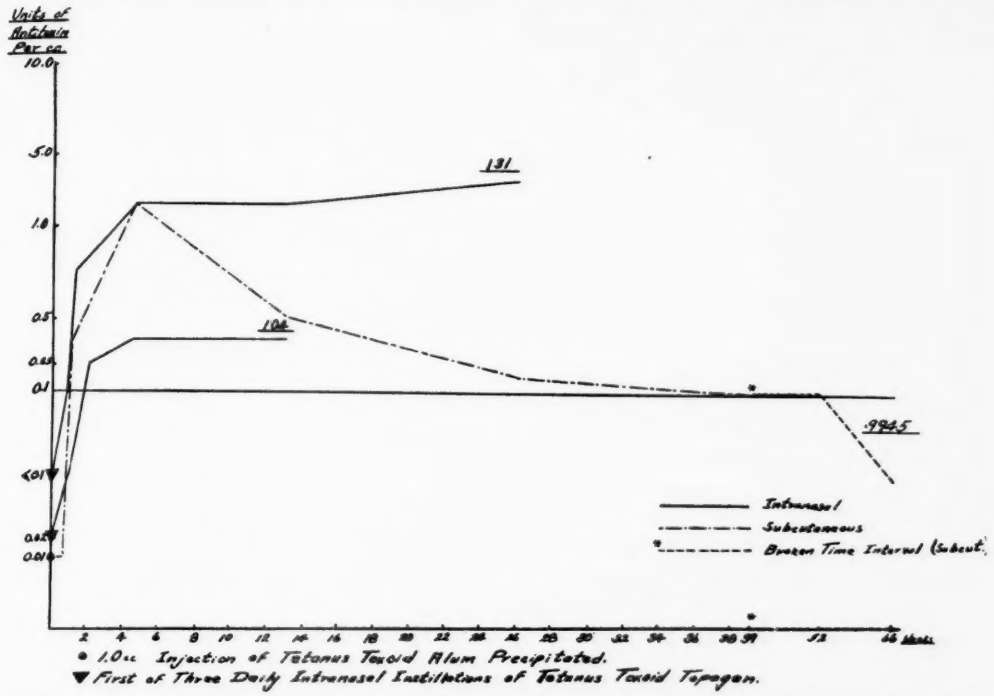


Chart II. Typical responses to tetanus toxoid topagen given intranasally as a "repeat dose." An average antitoxin curve obtained after the subcutaneous injection of alum toxoid as a "repeat dose" is plotted for comparative purposes.

It is clear that when tetanus toxoid topagen is given intranasally to individuals who had been previously injected with one, two, or more subcutaneous doses of tetanus alum precipitated toxoid, it acts as a good secondary stimulus resulting in a remarkable elevation of the antitoxin titer. This rise appears to be sufficiently prompt and should prove valuable if the intranasal toxoid is routinely given in advance of injury.

At present, we recommend that a course of nasal instillations should consist of three daily treatments (0.1 c.c. of tetanus toxoid topagen in each nostril) repeated every six months. This schedule and dosage are not final. Future work may show that better results can be secured by giving two daily instillations, repeated a week later.

Present experience has convinced us that the combined subcutaneous and intranasal method of immunization against tetanus is practical. It can be carried out with ease in controlled populations, such as the army and navy, and also in large industrial plants, whose employees are subject to frequent injuries.

COMMENT

Active protection against tetanus, both acute and chronic, is highly desirable. While undoubtedly efficacious, immunization by means of tetanus toxoid administered parenterally, has the drawback of requiring repeated injections at the time of injury. Intranasal immunization against tetanus is feasible and practical if it is looked upon as a means of creating a state of antitoxic immunity in advance of an injury. In order to produce and maintain this state of immunity, it is necessary first to render the subject capable of responding to tetanus toxoid topagen stimulation intranasally by means of the previous injection of a primary course of two 1.0 c.c. doses of tetanus alum precipitated toxoid given ninety days apart, and second, to repeat the course of nasal instillations every six months.

CONCLUSIONS

1. Tetanus toxoid topagen when instilled in the nose is absorbed rapidly and in sufficient quantity to bring about a rise in antitoxin titer, in subjects who had previously undergone active immunization against tetanus by means of one or preferably two injections of tetanus alum precipitated toxoid.

2. When 0.10 c.c. of tetanus toxoid topagen is dropped into each nostril on two or three successive days, or at weekly intervals, it will raise the antitoxin titer of actively immunized individuals from less than 0.10 unit to or above the 0.10 unit level in seven to nine days. The titer will remain above the protective level for at least several months.

3. No systemic reactions, and only a transient local nasal reaction, occur after instillations of tetanus toxoid topagen.

4. Active immunity can be maintained in advance of an injury by the repeated use of tetanus toxoid topagen intranasally. A course of three daily instillations should be repeated every six months.

I wish to thank the Mulford Biological Laboratories, Sharp and Dohme for the advice and coöperation given us throughout this experiment. I also wish to express my appreciation to Dr. E. A. Whitney, Medical Director of the Elwyn Training School, Elwyn, Pennsylvania, for allowing me to use inmates of this institution as subjects for this investigation. Allergic subjects included in this study were patients of the Allergy Clinic of the Chester Hospital.

REFERENCES

1. Ramon, G., and Zoeller, C. *Compt. rend. Soc. de biol.*, 112: 347, 1933.
2. Sacquepee, E. *Paris méd.*, 1: 491, 1933.
3. Sneath, P. A. T., and Kerslake, E. G. *Canad. M. A. J.*, 32: 132, 1935.
4. Bergey, D. H. *J. Infect. Dis.*, 55: 72, 1934.
5. Jones, F. G., and Moss, J. M. *J. Immunol.*, 30: 115, 1936.
6. Gold, H. *J. A. M. A.*, 109: 481, 1937.
7. Hall, W. W. *Mil. Surgeon*, 80: 104, 1937.
8. McBryde, A. *Southb. M. J.*, 30: 565, 1937.
9. Cowles, P. B. *Yale J. Biol. & Med.*, 9: 409, 1937.
10. Boyd, J. S. K. *J. Roy. Army M. Corps*, 70: 289, 1938.
11. Sewall, H. *Science*, 62: 293, 1925.
12. Sanarelli, G. *Compt. rend. Soc. de biol.*, 91: 1302, 1924.
13. Friedman, E., Esserman, A., and Black, M. H. *J. Pediat.*, 5: 504, 1934.
14. Major, R. H. *J. Lab. & Clin. Med.*, 21: 278, 1935.
15. Geiling, E. M. K. Glandular Physiology and Therapy. Chicago, 1935. A. M. A.
16. Slesinger, H. A. *J. Pediat.*, 9: 42, 1936.
17. Gold, H. *J. Pediat.*, 10: 641, 1937.
18. Dserzgowsky, S. K. *Ztschr. f. Immunitätsforsch. u. exper. Therap.*, 2: 602, 1910.
19. Zoeller, C., and Ramon, G. *Bull. Acad. de méd de Paris*, 97: 849, 1927.

20. Zoeller, C., and Ramon, G. *Presse méd.*, 35: 1049, 1927.
21. Ramon, G., and Zoeller, C. *Compt. rend. Soc. de biol.*, 97: 701, 1927.
22. Ramon, G., and Zoeller, C. *Compt. rend. Soc. de biol.*, 96: 762, 1927.
23. Lesne, E., et al. *Compt. rend. Soc. de biol.*, 96: 1205, 1927.
24. Salviolo, G. *Pediatria*, 36: 687, 1928.
25. Jensen, C. *Proc. Roy. Soc. Med.*, 30: 1117, 1937.
26. Bousfield, G., and King-Brown, W. W. *Lancet*, 1: 491, 1938.
27. Wenger, L. J., Hampil, B., and Masucci, P. *J. Bact.*, 36: 332, 1938.
28. Gold, H. *J. Allergy*, 8: 230, 1937.
29. Gold, H. *J. Lab. & Clin. Med.*, 23: 903, 1938.
30. Gold, H. *J. Allergy*, 9: 545, 1938.
31. Gold, H. *Ann. Int. Med.*, 13: 768, 1939.
32. Gold, H. *J. Lab. & Clin. Med.*, 25: 506, 1939.
33. Gold, H. Unpublished data.

The modern pointed bullet is more unstable than the blunt-nosed Mauser type, and inflicts more severe damage on internal organs. That is to say, there are relatively fewer clean perforations of bone and viscera, and more damage is done to the internal organs in the way of laceration and disruption.

From—"War Wounds and Air Raid Casualties" (Lewis).

THE CARE OF ADVANCED CANCER EXCLUSIVE OF THE RELIEF OF PAIN BY DRUGS*†

HARRY C. SALTZSTEIN, M.D., EDWARD H. LAUPPE, M.D.,

AND

MARTIN Z. FELDSTEIN, M.D.

DETROIT, MICHIGAN

IT may not be generally appreciated that statistically we cure very few cancer patients. Perhaps we cure 15 to 20 per cent of breast cancers (10 per cent of the total incidence of cancer); 10 to 15 per cent of cervical cancers (12 per cent of the total); an occasional rectal and colon cancer (15 per cent of the total), practically no stomach cancer (33 per cent of the total). Therefore the great bulk of all carcinoma patients must be cared for through a more or less protracted terminal illness (three months to three years), when the outlook is hopeless and the physician and family are often times discouraged. But, nevertheless, the patient is a human being, entitled to whatever expert care we can give or suggest.

Wild,[1] after a twenty-six year service in the care of these patients, wrote: "There is no greater test of the capacity of a medical man than his ability to retain the confidence of a patient who is steadily going downhill, and the management of a case of inoperable cancer will tax all the tact, knowledge and skill of the ablest practitioner."

The first consideration is the psychological approach. Should one tell a patient he has hopeless cancer? It is often a difficult situation, which must be answered differently for different types of people and personalities.

Wild was strongly of the opinion that it is most desirable to hold out the hope of recovery even to the last. The mental outlook of a man who believes his condition to be absolutely hopeless is quite different from that of a man who believes that he has even one chance in a thousand of recovery. It is usually best for the patient's morale not to tell him directly that he has a hopeless disease. "There is but one place where a man may wisely be thoughtless, his deathbed. No thinking should be done there," wrote Ruskin.[2] Hertzler feels that the average doctor is inclined to agree with him. From his crowded lifetime of intimate human contacts, Hertzler continues: "The most disastrous results may follow a tactless warning of even the true conditions. The family, or one member of it, may, as a matter of protection to the doctor, be given the true statement of the facts. One must use caution in the selection of the confidant, lest the information be blabbed to the patient, not through viciousness but just through the habit of telling all they know, plus imagination."

But there are exceptions, and each case must be handled individually. "Some patients tell the doctor they wish to know the truth, and by their bearing convince him that they mean it. I once had a patient of this type, a huge mountain of a man, a noted sheriff of the Southwest. For thirty years he had faced bandits and death many times in his career and he did not fear death from cancer. . . . Hope springs eternal. Some people refuse to recognize the fact when presented to them by the course of the disease. I once saw in

* From Mercy Hall Tumor Clinic and Hospital, Detroit, Michigan. Presented as a scientific exhibit at the meeting of the American Medical Association in San Francisco, 1938.

† A second article, entitled: "A Régime for Controlling Pain in Far Advanced Cancer" will follow in a succeeding issue.

consultation a very intelligent woman in the advanced stages of cancer of the breast. As I looked at the huge ulcerating mass she mildly remarked: 'You think you see a tumor, but you are wrong. There is none there; I am going to get well!' She denied that she suffered pain. . . .

"Sometimes the situations take on other forms. I once had a fine old gentleman with a cancer of the stomach. I told him that all I could do was to relieve, in a measure, his pain. He only asked to die to relieve his wife and his daughter of the care of him throughout the months to which my prognosis condemned him. Though he would leave them moderately comfortable financially, yet he had not enough to bear the expense of prolonged care."

In our experience, not more than 15 to 20 per cent of cancer patients are depressed. The instances where we have told a patient he or she has hopeless cancer are not many. They have been chiefly the intelligent persons, usually of phlegmatic disposition, who we have felt might coöperate better if they know all—and this has invariably been after a certain amount of acquaintance with the patient.

What is important is that the patient have cheerful surroundings and attendants. "Much of the gloom which surrounds some patients emanates from attendants, and this must not be. The physician should see to it that tranquility and beauty are found in the patient's environment and that anything which unduly irritates him is avoided."[3]

Symptoms can be discussed frankly, with never an air of hopelessness. Direct questions about prognosis can almost always be evaded or parried.

Nursing Care. If these patients are grouped in a service for far advanced care, much can be done for them by specialized nursing. The nursing staff is allowed more initiative than in ordinary hospital ward care, carrying out all ward therapy, including dressings, under supervision. A hospital bed, frequent change of bed linen, bodily warmth, cleanliness, may be sufficient to relieve pain.

Individual narcotic medication can also be handled better by the nurse in charge, under close supervision, than if the doctor sees the patient for a few minutes every day or two and prescribes fixed orders. Much depends on an individual's sensitiveness to pain, his reaction to different drugs, his tolerance for addiction. All of this can only be learned by the day to day hourly observation of the nurse, so that she is in a better position to administer the daily drug care than the doctor is, provided she has an understanding of the various narcotics, and has close coöperation with the medical staff.

A cancer patient can be kept more comfortable, with far less narcotic consumption, in a convalescent service with a few intelligent nurses working in this manner than in a busy general hospital where nurses change frequently, and the care of the patient must be routinized. Small wards, with single rooms, if at all possible, are desirable, because of the frequent terminal symptoms and frequent sudden deterioration and change in the patients condition.

Bed Sores. The best therapy for pressure sores is avoidance. A debilitated patient can get an intractable bed sore in one or two days.

General hygiene is important: rub the back (massage), etc. daily; keep sheets taut; avoid crumbs or other particles. Avoid pressure by changing posture frequently, using a water cushion, air mattress, cotton doughnut, pillow under the back or the knees, etc. Avoid maceration of the skin. Absorb discharges by frequent changes of dressings. If the skin is dry, use hydrous wool fat.

For a reddened area we use one of the following techniques:

1. Lather with fels naphtha soap, letting it dry, forming a paste. Keep patient off the part twenty minutes. Repeat twice daily every day for one week or until healed.

2. Paint with 5 per cent silver nitrate, or with collodion.

3. Elastoplast adhesive stretched tightly over the irritated area in two layers at right angles to each other.[4]

For an open ulcer:

1. 5 per cent tannic acid spray until a crust forms.

2. Light cradle. Surgical dusting powder. Keep superficial gangrene dry.

3. Elastoplast, applied as above in two tightly stretched layers placed at right angles to each other and left undisturbed for several days is an excellent method.

Ulcerated Lesions. If a bed sore extends, and one has cellulitis and moist gangrene to deal with, dressings should be changed frequently, or the ulcer will spread rapidly. Dead gangrene is debrided when the slough is loose.

Most ulcerated lesions (except bed sores) seen in terminal cancer are in and about the mouth and neck. The others are ulcerated breast cancer (very infrequent, considering the large number of cases), an occasional breaking down inguinal gland mass, or superficial sarcoma or other metastases.

Several recent studies have indicated that the germicidal value of local antiseptics is over-rated; body tissue cells are killed more quickly than are the bacteria. The important thing in the care of infected wounds is that nothing should interfere with the flow of lymph and phagocytic cells outward toward the wound surface. These liberate tryptic ferments which are active in combating septic organisms.

Frequent changes of dressings remove fibrin crusts and coagulated discharges which dam back this flow. Moist boric dressings changed every two to four hours, may do more for the patient's comfort than analgesics or sedatives.

Azochloramid is not as irritating as the older chlorine solutions were. There are several recent favorable reports showing shorter wound healing in series of cases with it than without it.[5] It is not expensive if a quantity of gauze is kept in a closed jar, and a small amount of azochloramid in triacetin poured over it, as recommended by the manufacturers. A small amount of the oily solution diffuses and spreads through a relatively large surface of gauze. Used continuously, there is occasional wound irritation and on rare occasions an increased liability to hemorrhage. These are not serious objections to its routine use. Within a few days a foul smelling neck wound can be rendered clean and comfortable. As an alternate dressing, simple vaseline dressings are soothing to an open neck or mouth wound. Cleanliness is especially important in mouth cases. A moist boric dressing must be changed frequently to give comfort, especially if there is contamination from mouth discharges. Otherwise it cakes up.

After the discovery that the virtue of maggot therapy of infected wounds lies in the urea excreted by the maggots, it was realized that urine, which contains the same concentration of urea (2 per cent) as is found in maggots, has been used therapeutically for superficial wounds and ulcers since Egyptian times.[6] Many persons can still be found who remember that their grandmothers bathed their childhood boils, chapped hands, styes, etc., with applications of urine. It is a stimulant to granulation tissue proliferation, and in no sense an antiseptic, since organisms grow rapidly in 2 per cent urea solution. We have found it of value especially in extensive ulcerating bed sores in 2 or 5 per cent solution. Urea crystals sprinkled directly into a sloughing wound, as advised by Millar,[7] are helpful in cleaning up a dirty wound. They may become irritating, however.

Another mild deodorant solution is a combination of pine oil U.S.P., linseed oil soap and distilled water marketed under the trade name solupin. It has a cleansing and peptizing (soap) action.

Meleney[8] has shown that the foul-odored mouth infections are due to anaerobic streptococcus plus the spirochetes and other fusiform bacilli of the mouth. This is the bacteriology of many cancer ulcerations

in and about the mouth. Though other oxidizing agents, potassium chlorate, potassium permanganate, sodium perborate are of value, zinc peroxide is much more effective.

A potent product "ZPO medicinal" is now marketed and commercially obtainable. It is heated dry to 140 degrees for four hours in small quantities, then mixed with distilled water to the consistency of cream and applied heavily with an asepto syringe. It may also be used as a mouth wash (diluted, one to four parts water) every three to four hours, ensuring good contact by swabbing crevices, etc., with cotton soaked swabs. A few days of such treatment may make the patient feel tremendously relieved, because of the elimination of anaerobic inflammation.

Another soothing mouth wash is detoxyl. Ordinarily bland mouth washes do not give the comfort these two preparations do, probably because of the heavy infection with anaerobic streptococci.

We have not as yet had the opportunity properly to judge the value of sulfanilamide, but this drug should have a wide field of usefulness in the infections and cellulitis of far advanced cancer—many of which contain beta streptococci infections. It has been recommended for infected carcinoma of the cervix before radium application.

For indurated brawny cellulitis heat should be applied, and watch kept for hidden abscesses: neck, post-maxillary region, breast, pararectal, pelvic region, etc. Hidden abscesses have been mistaken for fixed inoperable tumors, especially in the breast. Adequately draining a hidden abscess may relieve intractable pain in an unsuspected manner.

Macerated skin and irritation from discharges, as in the perineum, colostomy, neck, breast, are not problems if the wounds are cared for as above. If they are, one may use: (1) zinc oxide ointment; (2) tannic acid ointment or spray; (3) vaseline; (4) Aluminum ointment which is recently recommended and most efficacious.

Paint the involved surface with:

Powdered aluminum 1 part
Zinc oxide ointment U.S.P., 2 parts
Vaseline q.s.

or

Powdered aluminum
Facial cold cream q.s. to make soft thin paste.

The patient's skin looks like a household radiator, but it toughens and sheds watery discharges.

Hemorrhage. Five to 10 per cent of cancer patients die of hemorrhage. The event is usually dramatic and fatal, and except for the suddenness is often a merciful end. The lower uterine artery in cervical cancer most frequently gives way suddenly. Next come hemorrhages about the mouth and neck—lingual or facial arteries or other branches of the external carotid. Then come pulmonary or mediastinal growths (branches of the pulmonary arteries or the aortic side branches). Intra-abdominal ulcerations, generally into arteries in the omentum, an occasional artery in the thigh or other great vessel of an extremity make up the remainder.

Surgically, an occasional ligation of the lingual or facial artery can be done, but usually the growth has already ulcerated too widely for any surgical maneuvers. Deep *x*-ray therapy can give considerable palliation in checking hemorrhage, especially in the cervix, rectum and mouth. However, most of these cases have already had all the *x*-ray therapy they can stand several months before the onset of severe bleeding in the far advanced stage.

Though most hemorrhages are fatal within a few days, frequently the patient recovers, and may live four to six months longer.

General measures we have found of value are: (1) a heavy dose of morphine or H.M.C. repeated in one-half hour with the patient kept deeply in sedation for one to two days (dilaudid does not give deep enough sedation); (2) moccasin snake venom; (3) fibrogen, lung tissue; (4)

neohemoplastin and hemostatic blood derivatives.

Locally the usual custom is to pack tightly with iodoform gauze. Sometimes we pack a profuse vaginal hemorrhage from cervix cancer; sometimes we leave the patient alone and give heavy morphine doses for one to two days. Our clinical impression frequently is that the bleeding stops as well under the latter treatment as the former.

Styptics form a protein precipitate which occludes the lumen of small vessels. They control oozing, but not spurters. Large clots should be removed, since such medicaments must come in contact with bleeding vessels. Other measures are: tannic acid 5 to 10 per cent solution; monsells salt (ferric subsulfate)—powerful, but leaves a dirty coagulum; granulated sugar, an old remedy, still useful in an emergency; thromboplastin, ox brain tissue cephalin; stipven—viper snake venom,[9] hemostatic erce.

Another old remedy useful occasionally in cervical cancer is acetone. Instill ½ to 1 ounce of acetone into the vagina through a tubular speculum and hold it in place fifteen to twenty minutes, avoiding skin irritation. Repeat every other day as indicated. Old gynecology texts referred to cures of cervix cancer by this method before the advent of radiation therapy.

Respiratory Tract Lesions. The patient can easily be taught to use a suction aspirator with a tracheotomy tube. At frequent intervals, a catheter should be inserted far down the trachea to aspirate the pool of secretions which always collects there.

The chronic cough of pulmonary metastases or chronic bronchitis and bronchiectasis surrounding metastatic masses from pharyngeal ulcerations is difficult to treat. However, except for the discomfort of the chronic cough, it is not very troublesome, as cancer symptoms go. The usual cough remedies do not have much value in our experience. A small dose of dilaudid (gr. 1/32) allays the cough reflex and gives temporary relief. This can be repeated. Careful watch for pleural effusions is made. These are usually terminal events, but at times breast cancer metastasizes chiefly in the pleura, and repeated aspirations may keep the patient comfortable for four to six months. *X*-ray often has considerable palliative value in preventing effusions reforming quickly.

The severe dyspnea of mediastinal growths is likewise hard to treat. After *x*-ray palliation is ended, there is not much left to offer the patient.

Abdominal Cancer. When cancer grows heavily in the abdominal cavity, nausea, anorexia and weakness are the chief symptoms. In our experience liver metastases are not painful. If the mass presses on a hollow viscus or involves the retroperitoneal tissues, there is apt to be pain, but otherwise pain is not a prominent symptom. Much can be done for some of these patients without recourse to narcotics.

1. Bowel hygiene—either enemas or mild laxatives.

2. Control of anemia, if possible. If there is no chronic infection, these patients can be made to feel a good deal better by giving them some iron preparation, such as: reduced iron (capsules gr. 7½ six times daily), ferrous sulfate (tablets gr. 3 three or four times daily), or iron ammonium citrate (90 gr. daily).

3. Improvement in appetite. Taka diastase is a mild remedy. Insulin, 5 to 10 units before meals is at times very helpful and is being used more and more for debilitated conditions.

4. Vitamin B_1 has recently been shown to have a profound influence on glycogen metabolism in the liver; also it has a close relationship to the extrinsic factor in anemia. It is not stored in the body, and if the supply in the food is insufficient, or the disease causes rapid wasting e.g., tuberculosis, cancer, or increased metabolism, it is used up rapidly. Much temporary improvement in appetite and relief of nausea can frequently be obtained by

two tablets of thiamin chloride (or the whole B complex) three times daily on an empty stomach. It has been used with success for the nausea of radiation sickness.

5. Vomiting and nausea are often due to dehydration. Hypodermoclysis, 750 to 1,000 c.c. daily for three to four days may restore this balance.

6. Ascites is most commonly seen in carcinoma of the ovary, sometimes in carcinoma of the rectum or colon, more rarely in upper abdominal cancer. We have had only very moderate success with the newer diuretics, salyrgan, mercurin, etc., in these cases. Abdominal paracentesis gives some relief, but the fluid soon refills and it is usually a terminal event. *X*-ray therapy has produced palliation and prevented refilling for several months.

These measures are of course palliative, but they frequently spare morphine for a few to several weeks and make for a much more comfortable and satisfied patient. It is in these cases especially that morphine increases constipation, nausea and anorexia.

Cervix. Cervix patients suffer from the offensive discharges and the pain in the back, thighs and lower abdomen. For the discharge, solupin (mentioned above under care of wounds) used as a douche once or twice daily (diluted 1:10) relieves the odor in a high percentage of cases. Another remedy is charcoal and iodoform in equal parts, instilled into the vagina or on a tampon.

For a rectovaginal fistula, if the patient is in fairly good condition (life expectancy perhaps three months) we usually advise abdominal colostomy. The patient is much better off with the abdominal anus, for it can be controlled better than the continuous fecal vaginal discharge, and the irritation of feces in the vagina is avoided.

The bladder fistulae from cervical cancer have been a problem. We have in the past kept these patients comfortable with a complicated arrangement of rubber gauze and sheet pads which the patient changed herself every one-half to one hour. Recently we have used continuous suction through a gauze wick in the vagina attached to a perforated catheter lying outside the vagina.[10]

A wick of gauze is placed 2 or 3 inches into the vagina. Just outside the vagina, on the inner side of the thigh, it is attached to a perforated catheter. A suitable type (Hendrikson) may be purchased, or a few perforations are made in a large tube, or the end of the gauze wick is stuffed into the end of a large tube. The tubing is led over the patient's thigh, to a drain bottle hanging on the bed or on the floor. The exit tube from the bottle is attached to a suction pump, either electrically driven (Stedman) or attached to a water pump (Penberthy Injector) or any other apparatus for producing moderate vacuum suction. The gauze wick is changed daily or as often as necessary.

The back pain will be considered later.

Bladder and Prostate. Prostate cases can be made comfortable by transurethral punch operation, which can be repeated. Suprapubic cystotomy often becomes necessary later. Bladder cancer usually requires suprapubic cystotomy because of the violent dysuria.

Regarding the care of cystotomy wounds: the tube should be irrigated frequently (daily or oftener). There may be no leakage around the tube, and no dressings whatsoever required, although this is more apt to be true in prostate than in bladder carcinoma. If there is leakage around the suprapubic catheter, a similar continuous suction, with a gauze wick lying free in the urinary seepage and attached to a perforated catheter will keep the patient dry. We have done bilateral ureterostomy where the bladder was too extensively infiltrated for suprapubic drainage. The pain of dysuria is entirely relieved. The wound may be kept dry by using a small size Foley catheter (No. 18 is the smallest manufactured) which has a distensible balloon fashioned on the outer surface about ½ inch from the end. This is inflated by air or water through a

separate tube built in alongside the main catheter. If the ureter is or can be dilated at all from back pressure, the catheter end can be introduced, the balloon distended in the ureter just beneath the skin, and a water tight drain obtained. The patient is bedridden and the tube must be changed frequently, but the violent dysuria is gone.

These patients often become dehydrated. Again much comfort can be given by simple forcing of fluids.

Odors. The foul odor of terminal cancer comes chiefly from cervix discharges, especially when there is a bladder fistula, other draining urinary wounds, and face, neck or breast wounds which have been neglected. With the above regime, there is very little odor in the wards. Electrically driven deodorizers can be purchased, working on the principle of either sucking air into an exhaust or breaking down the air molecule and liberating ozone.

Intractable Pain. The worst cases are those of pain in the back, posterior thigh, and lower abdomen in cervical cancer. This is not due to spinal metastases nor to pressure on large nerve trunks in the pelvis, but probably to irritation of sympathetic nerve plexus endings in the pelvis from the inflammed mass. Elsewhere we have reported our experiences with spinal alcohol injections[11] whose greatest field of usefulness is in just these cases. The vise-like low back pain is almost always relieved—or made so much better that codeine and aspirin three or four times a day will relieve it. There may be some residual low anterior abdominal pain or pain in the region of the coccyx. This may require a second injection placed carefully at a different spinal level.

Spinal metastases from breast cancer similarly respond to alcohol injections, although the result is variable. Deep *x*-ray therapy may cause breast cancer spinal metastases to recalcify, and complete relief will be obtained for four to eight months. Spinal metastases from prostate cases respond in about 50 to 60 per cent of cases to either *x*-ray therapy or alcohol injections. The usual procedure is to try *x*-ray first; after full benefit has been obtained and pain recurs later, spinal alcohol can be given. Spinal alcohol injections can be tried for any intractable pain below the collar bone. The best results are obtained by those who carefully plot out the nerve distribution and afferent pathways from the site of the pain, and inject where these enter the spinal cord. Danger of paralysis of the bladder and rectum can be avoided by slow injection and safe dosage. This treatment has taken the place of cordotomy in reports from several clinics and individual observers. Cordotomy may be done later if indicated and if the life expectancy is sufficient to warrant it.

Breast Cancer. Often 25 to 30 per cent of the beds in a terminal cancer service are occupied by breast cancer patients. They show a more variegated terminal picture than those with cancer of other organs. We have seen some of these cases bedridden for eighteen months to two years, with spinal paralysis coming on, then improving somewhat; with cerebral symptoms pronounced to the point of coma, then clearing. Prognosis must be guarded, and indications for therapy met as they arise. The usual cough from chest metastases is not very painful. The vomiting and nausea of intra-abdominal, chiefly liver, extention is treated as above indicated, as is also the pain of spinal metastases. Skin metastases require no treatment. Some remarkable disappearances of bone metastases have been reported following irradiation of the ovaries if the patient still menstruates.[12] We have seen the symptoms of far advanced breast cancer improve coincidentally with the normal menopause being established.

Palliative Operations and X-ray Therapy. Many of these patients are dehydrated, suffering from sepsis and liver exhaustion. There is always the liability of unsuspected internal metastases. Before any operation is done for far advanced cancer one should

carefully weigh: (a) the risk involved; (b) the probable life expectancy; and (c) the amount of palliation which the operation will bring. This is especially important in abdominal cancer, where it is not unusual to have a sudden exitus a few days after laparotomy, which comprised only an abdominal incision, a quick exploration and closure. All hospital record rooms have many such charts. A few days clinical hospital observation of these patients, careful estimation of fluid balance, blood chemistry, anemia, etc., will avoid a good many of these occurrences. They do nobody any good. We feel that the chief unsuspected risk comes from an exhausted liver which cannot be estimated clinically before the operation. The risk and potential palliation may be explained to the family and the decision left to them. Sometimes they want everything possible done for the patient; at other times they prefer not to have him "bothered" or "tortured."

Similarly, we have seen many cases where protracted *x*-ray therapy did no good. Sufficient experience with this valuable therapeutic agent has now accumulated, so that it should be given on more definite indications, and not to every cancer patient to whom nothing else can be offered. It is not entirely harmless. Occasionally the rapid deterioration following *x*-ray therapy is more than coincidental. Such cases are not numerous, but they occur in the experience of all who see many of these patients.

COMMENT

The symptoms complained of during the far advanced stages of cancer depend not upon "general exhaustion," "general debility," "cancer cachexia," etc., but upon the particular pathologic change which cancer produces in the particular organ or body site where it is active. A local ulceration causes sepsis; aspiration of mouth discharges causes bronchitis and bronchiectasis; a hollow viscus may be obstructed or a fistula drain to the exterior from an internal organ. Pain is due to a variety of pathologic processes. The treatment must seek to differentiate these causes, and be particularized to each of them.

SUMMARY

A régime for the care of far advanced cancer patients is elaborated.

The following considerations in therapy are discussed: the psychologic approach; nursing care; bedsores; ulcers; odors; discharges; the peculiarities of abdominal cancer; fistulae from hollow viscera; hemorrhage; intractable pain; palliative operations.

The importance of treating the exact cause of the discomfort rather than loading the patient with narcotics, is emphasized.

REFERENCES

1. Wild, R. B. Address on treatment of patients with inoperable cancer. *Lancet*, 2: 1062–1064 (Nov. 24) 1928.
2. Hertzler, A. E. The Horse and Buggy Doctor. 1938.
3. Jackson, Henry, Jr., and Minst, G. The medical care of the cancer patient. *Am. J. Cancer*, 15: 8 (Jan.) 1931.
4. Carty, T. J. A. Treatment of bedsore with elastic adhesive plaster. *Brit. M. J.*, 1: 105–106 (Jan. 18) 1935.
   Fantus, B. Therapy of Cook County Hospital; therapy of bedsores. *J. A. M. A.*, 104: 46–48 (Jan. 5) 1935.
   Fantus, B. Advances in therapeutic technic. *J. A. M. A.*, 105: 877–881 (Sept. 14) 1935.
5. Forrest, Young. Treatment of surgical infections with new chlorine solutions. *Surg., Gynec. & Obst.*, 63: 318–324 (Sept.) 1936.
   Sutton, L. E., and Van Duyn, John. Treatment of infected wounds with azochloramid. *New York State J. Med.*, 36: 1835–1838 (Dec. 1) 1936.
   Kennedy, R. H. Use of azochloramid in infected wounds. *Am. J. Surg.*, 31: 294–299, 1936.
6. Foulger, J. H., and Foshay, L. Antiseptic and bactericidal action of urea. *J. Lab. & Clin. Med.*, 20: 1113–1117, 1935.
   Robinson, W. Use of urea to stimulate healing in chronic purulent wounds. *Am. J. Surg.*, 33: 192–197 (Aug.) 1936.
   Muldavin, L. F., and Holtzmann, J. M. Treatment of infected wounds with urea. *Lancet*, 1: 549–551 (March 5) 1938.
7. Millar, W. M. Urea crystals in cancer. *J. A. M. A.*, 100: 1684 (May 27) 1933.
8. Meleney, F. L. Prophylactic and active use of zinc peroxide in foul smelling mouth and neck infections. *Ann. Surg.*, 107: 32–38 (Jan.) 1938. Bacteriology of amputations. *S. Clin. North America*, 18: 321–328 (April) 1938. Use of zinc

peroxide in oral surgery. *Internat. J. Orthodont.*, 23: 932–940, (Sept.) 1937.

Meleney, F. L., and Johnson, B. A. Further laboratory and clinical experiences in treatment of chronic undermining burrowing ulcers with zinc peroxide. *Surgery*, 1: 169–221, (Feb.) 1937.

9. Mac Farlane, R. G., and Barnett, Burgess. Haemostatic possibilities of snake-venom. *Lancet*, 2: 985–987 (Nov. 3) 1934.

Burgess, Barnett. Haemostatic uses of snake venom. *Proc. Roy. Soc. Med.*, 28: 1469–1472, 1935.

10. Saltzstein, H. C. A simple method for keeping bladder fistulas from cervix cancer dry. *Surg., Gynec. & Obst.*, 69: 111–112 (July) 1939.

11. Saltzstein, H. C. Intraspinal (subarachnoid) injection of absolute alcohol for the relief of intractable pain. *Internat. Clin.*, 3: 167–182 (Sept.) 1938.

12. Taylor, G. W. Rationale of artificial menopause in carcinoma of breast. *Am. J. Roentgenol.*, 39: 419–421 (March) 1938.

Dresser, R. Effect of ovarian irradiation on bone metastases of cancer of the breast. *Am. J. Roentgenol.*, 35: 384–388 (March) 1936.

Clarkson, W., and Barker, A. Five year cures of mammary carcinoma with multiple metastases to bone. *Am. J. Roentgenol.*, 36: 615–621 (Nov.) 1936.

Causalgia is not an organic disease, but a functional one. It seems to be brought about by vaso-motor disturbances at the site of any wound whatever, whether affecting the connective or muscular tissues, the adventitia of an artery or vein, or the supporting connective tissues of a nerve.

From—"Surgery of Pain" by René Leriche (Williams and Wilkins).

PROTRUDING EARS: A METHOD OF PLASTIC CORRECTION

GORDON B. NEW, M.D. AND JOHN B. ERICH, M.D.

Section on Laryngology, Oral and Plastic Surgery, The Mayo Clinic

ROCHESTER, MINNESOTA

AMONG the most engaging of purely plastic surgical problems is the correction of protruding deformities of the ears. (Figs. 1 and 2.) There is a certain degree of fascination in transforming such a deformed auricle from a state of distortion to one of normalcy, the result of which not only improves the general appearance of the patient, but also, in turn, often agreeably alters his mental outlook and emotional stability. It is interesting and instructive to review the procedures which have been advocated in years past for the repair of such deformities, and to discover that by a process of trial and error the surgical technique has undergone a series of gradual steps toward perfection. Although, year after year, new details of technique have been proposed which have elevated these operations from a state of crude experimentation to accomplished attainments, it must be admitted by all that surgical methods of the present day for the correction of protruding deformities of the ears still are not in a final stage of faultlessness. There is yet opportunity for improvement.

A protruding deformity of an ear in itself is a trivial matter, but the detrimental effect of such a deformity on the personality of some individuals is extremely significant. If such a malformation does not induce an actual obsession, in many instances it produces an exaggerated feeling of inferiority with all the attendant and subsequent complications usually associated with such a sense of inadequacy. Few of us realize the amount of mental discomfort endured by some sensitive individuals who have abnormalities such as this, and few appreciate the satisfaction of mind which these people gain by a plastic adjustment of this unnatural conformation of the ears. When this deformity is the fundamental basis for an obsession or an inferiority complex, correction of the abnormality promptly removes the mental or emotional symptoms. Even assuming that a deformity such as the one under consideration has produced no mental symptoms whatever, there is nothing incredible in the fact that a person with severely protruding ears should wish to improve his personal appearance. Then, too, it is a matter of common knowledge that even a few intelligent and well-educated people find it impossible to obtain certain types of positions because of this deformity. Consequently, it is indeed fortunate for many individuals that plastic procedures have been developed for the correction of such deformities.

An outstanding ear is the result of a congenital malformation of the anthelix. Normally, the contour of this part of the auricle is convex as viewed from its ventral surface. (Fig. 3.) It is this marked convexity of the cartilaginous anthelix that bends the scaphoid and helical portions of the ear inward toward the head and prevents their protrusion. (Fig. 4.) In an outstanding ear, however, the anthelix is flattened or actually concave, and the helix of necessity stands away from the head. (Fig. 5.) What embryologic factors produce this flattening or concavity of the anthelix are unknown. To make a broad statement, it might be said that the cephalo-auricular angle is decreased in proportion to the increase of convexity of the anthelix.

This generalization, as a matter of fact, forms the basis of treatment in the more recently devised operations for the correction of outstanding ears; the aim of these surgical procedures is to restore to the anthelix its normal convexity, which, in

turn, mechanically deflects the ear inward toward the head. This is usually accomplished by incising the auricular cartilages entering school, so as to preclude the possibility of his developing emotional disturbances as a result of the abnormality.

FIG. 1. Wax moulage of a patient with a marked degree of protrusion of the ears.

FIG. 2. Wax moulage of the same patient after a plastic reconstruction of the ears.

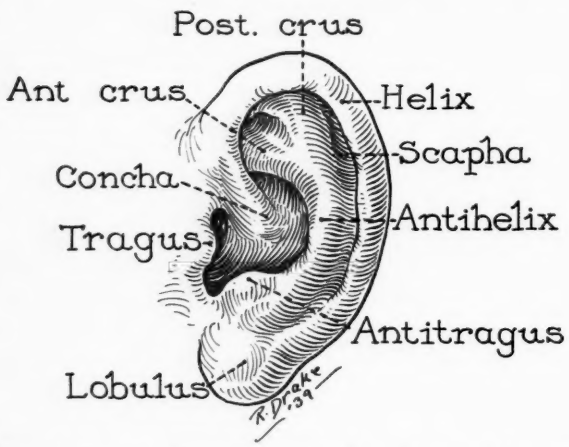


FIG. 3. A normal ear demonstrating the convexity of the anthelix and its posterior crus.

in a vertical direction along the line of the anthelix. Then by folding the cartilage and suturing the cut edges the parts lie side by side (Fig. 6), and the protruding appearance of the ear is remedied.

This malformation is bilateral in most cases. It is a deformity which can be corrected satisfactorily at almost any age. A child with outstanding ears is best operated on when he is about 5 years old, before Such operations at this early age apparently do not interfere with the subsequent normal growth of the ears.

We wish to describe a method which we have devised for the plastic correction of abnormally protruding ears. In many respects, the technique of this operation is similar to that set forth by others; the principal point of difference lies in the manner of inserting the sutures which form or mould the anthelix. Although we do not wish to discredit other methods, we are of the opinion that our plan has two advantages over other procedures. First, it permits of bending the auricle backward to any desired extent as a final step in the operation even after the wound has been completely closed. Second, it facilitates establishment of the same cephalo-auricular angle on each side when the deformity is bilateral.

Although the details of this operation are, except in the method of suturing, somewhat analogous to those outlined by Davis and Kitlowski,[1] and by MacCollum,[2] there are enough minor variations to warrant

giving a full account and description of the technique which we employ.

In performing an operation for protruding ears, many surgeons prefer to place the patient in a prone position on the operating table. However, since by our method the ears are tied back as a final step in the plastic procedure, we believe that it is advantageous to have the patient on his back; this permits a full view of the face so that one can judge best whether or not the relative final position of the two ears is symmetrical.

The hair is shaved for a distance of about 1 inch away from the ears, and the patient is anesthetized by the intratracheal method, employing nitrous oxide, gas and ether. The auricles are then painted with tincture of merthiolate, and sterile towels are draped about the patient, leaving both ears exposed. Even when the deformity is unilateral, it is well to leave the uninvolved ear uncovered for comparison with the malformed member. By proper arrangements, the towel which covers the front part of the head may be turned down, thus permitting inspection of the entire face at any time.

Before incising the skin, the proposed position for the anthelix is outlined with an indelible pencil on the anterior aspect of each ear, and novocaine containing adrenalin is injected subcutaneously on both the anterior and posterior auricular surfaces for hemostasis. An elliptical piece of skin which includes the sulcus formed by the junction of the auricle with the head, is excised from the dorsal surface of the ear. (Fig. 7.) At its greatest width this strip of skin measures about 1 cm. In a vertical direction, this excision of skin should be extended from the point at which the helix joins the temporal region to the lobule below.

By undermining and reflecting the cutaneous margins of the wound, an excellent exposure of the dorsal surfaces of the auricular cartilages is obtainable. With the aid of a hypodermic needle dipped in methylene blue, the position of the anthelix as previously outlined in pencil on the ventral surface of the ear can be transferred to the cartilage. This is accomplished by repeatedly thrusting the needle through the full thickness of the ear along the pencil-drawn line of the anthelix. As a result of this procedure, a series of blue spots is produced on the exposed surface of the cartilage. (Fig. 7.) This row of dots serves as a guide for the excision of an elliptical piece of cartilage which at its widest point should not exceed 5 mm. (Fig. 7.) A small scalpel and periosteal elevators are employed in removing the cartilage.

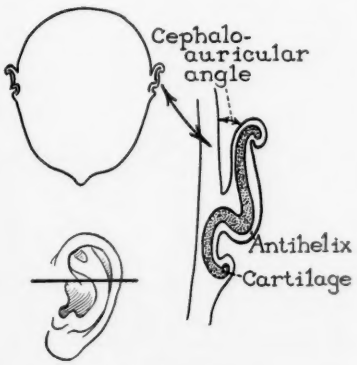


Fig. 4.

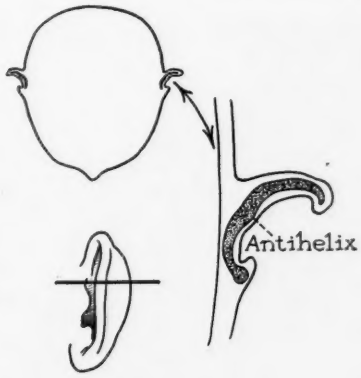


Fig. 5.

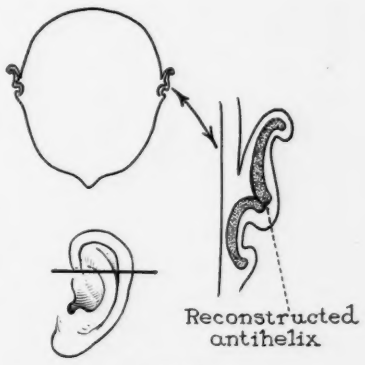


Fig. 6.

Fig. 4. Cross section of a normal ear illustrating the marked convexity of the anthelix.

Fig. 5. Cross section of an outstanding ear illustrating the flattened anthelix and the resultant protrusion of the scaphoid and helical portions of the auricle.

Fig. 6. Cross section of a reconstructed protruding ear. After excising an elliptical strip of cartilage, correctly inserted mattress sutures evert the cut edges of the cartilage so as to produce a normally convex anthelix, which, in turn, rectifies the abnormal state of protrusion.

It is of the utmost importance in this operation to make certain that the excised strip of cartilage extends the entire length

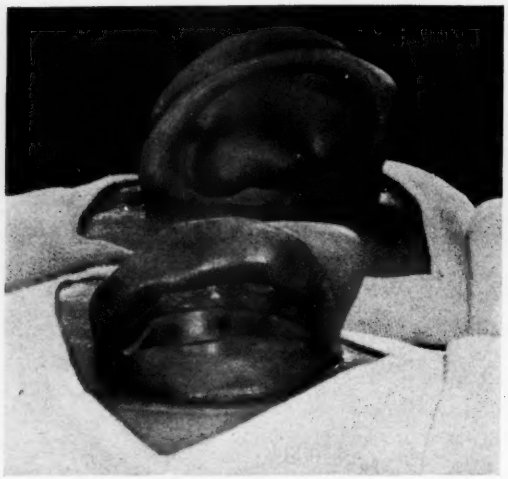


Fig. 7. Wax moulage of a protruding ear as seen from its posterior surface. The anterior auricular surface, which is visible, is a mirror image. In order to expose the cartilage, the skin is incised and reflected as illustrated. The series of dots marks the proposed position for the anthelix. One may note the outline of the elliptical strip of cartilage, which is being excised.

of the ear actually to divide the auricular cartilages into two separate and distinct parts. Even a small bridge of cartilage remaining between these two cartilaginous parts possesses an elastic force sufficient to restore the ear more or less completely to its original form. On examination of a microscopic section of the full thickness of the ear, it is amazing to observe the abundance of elastic fibers that lie in every direction within the cartilage and perichondrium. There is little wonder that an ear will resume its original shape unless the cartilage is completely severed. Rather than remove an elliptical piece of cartilage, some surgeons prefer merely to incise the cartilage along the line of the anthelix. However, in our experience, the ear can be folded back with greater ease if a narrow strip of cartilage is excised.

Through personal communication, we understand that J. P. Webster does not incise the cartilage but merely reduces its thickness in the region of the anthelix by a process of shaving. He claims satisfactory results from this procedure.

Complete hemostasis is a valuable aid

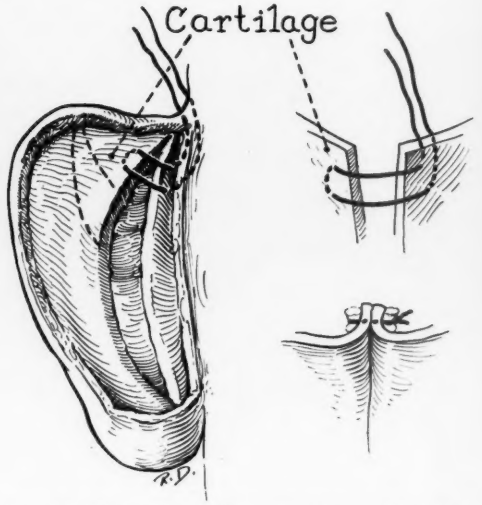


Fig. 8. Diagram of the posterior surface of a protruding ear. The skin has been entirely removed to give a better view of the auricular cartilages. This drawing illustrates the elliptical strip of cartilage which has been removed, and the method of inserting mattress sutures from the anterior surface of the ear through skin and cartilage. On tying these sutures over small cotton rolls, the cut edges of the cartilage are everted to produce a convex anthelix. The dotted margins of the triangular area on the upper portion of the auricular cartilage indicate the site at which a secondary wedge of cartilage may be removed for the construction of a convex posterior crus; this procedure counteracts any tendency of the upper portion of the ear to lop forward.

toward prompt healing of the wound. Before suturing, much care is taken to insure a dry wound by ligating every vessel which may continue to ooze. Mattress sutures are next inserted. Usually, four in each ear are required, and white silk is the preferred suturing material because of its strength. Each mattress suture is introduced from the anterior aspect of the ear, through the skin and cartilage and across the cut edges of the cartilage posteriorly.

The course of these sutures through the ear can be explained more intelligibly by means of diagrams (Figs. 8 and 9) than by a written description. Although inserted at this stage of the operation, these sutures are left untied until the cutaneous edges

of the wound are carefully approximated with interrupted fine black silk sutures. Following this closure of the wound, the mattress sutures are tied firmly over small cotton rolls. (Figs. 10 and 11.) The tying of these sutures effects the following results: the cut edges of the cartilage are everted and brought together side by side; this produces a convex anthelix, which, in turn, rotates the scaphoid and helical portions of the ear inwardly so as to correct the deformity. The amount of inward deflection of the ears is governed by the degree of tension placed on the mattress sutures when tied. It is well to remember that the normal cephalo-auricular angle should be about 30 degrees. In some cases, it is desirable to expose the face and tie the mattress sutures in each ear simultaneously; this insures a symmetrical alignment of the two ears.

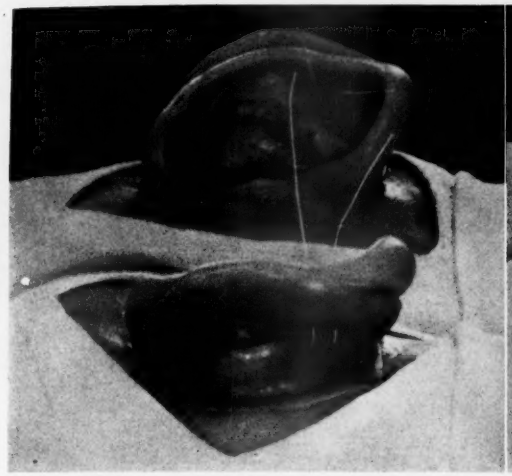


Fig. 9. Wax moulage of a protruding ear. The anterior surface is a mirror image. The method of inserting a mattress suture from the anterior auricular surface through skin and cartilage is demonstrated.

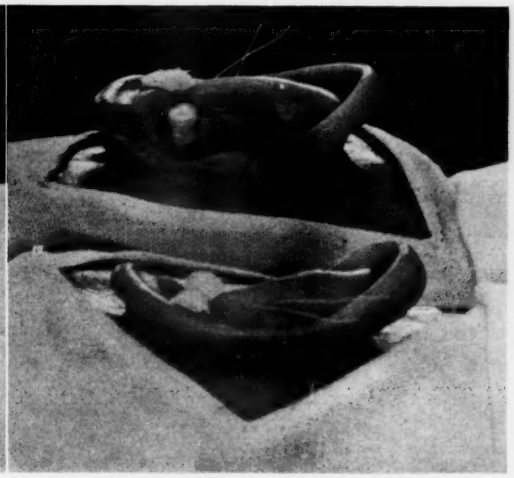


Fig. 10. Wax moulage of a protruding ear. The anterior surface is a mirror image. The manner in which the mattress sutures are tied over cotton rolls after the cutaneous incision has been closed with interrupted silk sutures is demonstrated. Notice the marked convexity of the anthelix produced by tying these mattress sutures and how the ear is folded in toward the head.

Fig. 11.

Fig. 12.

Fig. 11. Diagram of a reconstructed protruding ear with mattress sutures in position and tied over small cotton rolls. A marked degree of convexity of the anthelix has been attained by this procedure, and the deformity of the ear accordingly has been corrected.

Fig. 12. Diagram of a reconstructed protruding ear in which the convexity of both the anthelix and the posterior crus have been increased, the latter to overcome any tendency of the upper portion of the ear to lop forward. Necessary mattress sutures are in position.

It is our opinion that external mattress sutures offer a more effective means of forming the anthelix than do subcutaneous catgut sutures. If the latter are employed, after the cutaneous edges have been sutured, there is no possible way of adjusting the position of the ear without opening the wound. Furthermore, such catgut sutures occasionally become absorbed before the healing process is complete; should an infection of low grade occur, the catgut will disintegrate when, perhaps, its tension is most desirable. The use of white silk mattress sutures obviates such complications.

On completion of the operation, sterile gauze is lightly packed into the convolutions of the ears and a firm head bandage is applied. Four or five days later, the bandage is temporarily removed while the black silk skin sutures are taken out. About three weeks after the operation, the bandage and mattress sutures are removed, and the patient is instructed to maintain pressure on his ears with adhesive tape for at least another two weeks. After this length of time, there is no danger of the ears reverting to their original distorted state.

In the majority of cases of protruding ears, the technique as described will correct the deformity very satisfactorily. However, in a few instances, the uppermost portion of the ear tends to lop over through the scaphoid region, and no amount of tension on the mattress sutures will overcome this limp, hanging tendency, which greatly impairs the final cosmetic result. Examination of a normal anthelix reveals a markedly convex posterior crus which passes directly upward with a slight forward inclination. Any congenital flattening of this anatomic division of the auricle permits the upper pole of the ear to lop forward. Correction of this deformity is possible by accentuating the convexity of the posterior crus. When removing the elliptical piece of cartilage to form the new anthelix, a secondary small strip can be excised in the region of the posterior crus. (Fig. 8.) One or two mattress sutures properly placed will increase markedly its convexity and this, in turn, will fold the drooping portion of the ear back into a more normal position. (Fig. 12.)

CONCLUSION

The successful correction of outstanding ears depends on many factors, but primarily on a careful preliminary inspection of the ears, especially in reference to the anthelix and its posterior crus, and a foreseeing plan of treatment in each individual case. In our experience, it would seem that the more perfectly one can mould such a distorted auricle to conform to the normal, the more certainly can one anticipate a satisfactory result.

REFERENCES

1. Davis, J. S., and Kitlowski, E. A. Abnormal prominence of the ears—a method of readjustment. *Surgery*, 2: 835–848 (Dec.) 1937.
2. MacCollum, D. W. The lop ear. *J. A. M. A.*, 110: 1427–1430 (Apr. 30) 1938.

SEVERE INJURIES OF THE FACE

SOME CONSIDERATIONS IN THEIR DIAGNOSIS AND TREATMENT

ALLYN KING FOSTER, JR., M.D.

Junior Assistant Surgeon, New York Post-Graduate Hospital

NEW YORK CITY

THE purpose of this article is to present some principles in diagnosis and a discussion of some indications for treatment which should be routinely followed in injuries of the face. Several experiences in maltreatment and careless routine neglect of patients have led to these suggestions on this subject. Entirely competent physicians seem to be at times unaware of their responsibilities in complicated cases.

When a physician takes on the responsibility of treating traumatic cases, he must have had a minimum of training to satisfy the requirements of the state, national, and often the workmen's compensation laws. The average doctor, however, does not always have sufficient graduate training to qualify him as a specialist in general surgery, traumatic surgery, eye, ear, nose, and throat surgery, brain and nervous system surgery—all combined. In many cases it is to the advantage of the patient to have the neuro-surgeon, eye and ear man, general surgeon and reconstructive surgeon join forces.

EYE INJURIES

As a result of this lack of training there is probably no greater error than superficial inspection of eye injuries, even though no visible laceration is at first suspected. It is of utmost importance to diagnose the condition of the interior of the orbit as well as merely to observe, let us say, a slight ecchymosis of the lower lid. Intelligent patients may help in the diagnosis of difficult conditions by remarks about loss of vision in this or that quadrant. They may report a "hazy blur" instead of the usual clear vision. This may suggest anything from a dislocated lens to a detachment of the retina, or hemorrhage into the vitreous from a ruptured sclera and deeper layers of the eye.

On the other hand, a patient who has partly lost consciousness or who is in shock due to other more pressing injuries, may neglect to mention his half blind eye, or not notice it himself until long after the injury. Any injury to the face should therefore warrant an eye examination sufficient to prove good function, allow visualization of the fundus, and permit a gross estimate of the intraocular tension. It is not well enough known that even light blows on the eye or head may damage the eye, although nothing is suspected either by the coöperative patient or the examiner until several hours or days later.

A neglected patient who never knew he had a hemorrhage behind the retina, a dislocated lens, or a traumatic cataract may not associate trauma with the gradual decrease in vision of one eye until some days or months later. It may be years before an observing individual notices that one eye looks a little queer and seems at times to "wander" or "cross" with the other eye. So many of these cases are seen by eye specialists years after the original injury, that it is small wonder that the general surgeon never hears much about the part he and his colleagues may have unwittingly played in neglecting to diagnose the original lesion.

Seemingly mild external wounds may accompany severe internal hemorrhage or disruption of the retina and ciliary body.[2] The time to insure proper care is immediately after the accident, and not a day or two later when the ophthalmologist makes rounds. Small piercing wounds within the cornea or near the limbus are so productive

of serious loss of useful vision after they are healed, that no time should be wasted in securing accurate diagnostic and therapeutic aid.[3,4] Every case of facial injury should be examined as if there might be a detached retina, a puncture of the sclera, internal eye hemorrhage, or other serious damage. Outside help may then be necessary, unless the examination is complete enough to warrant a safe prognosis.

The diagnosis of most eye injuries is not really difficult. Some knowledge of the use of the ophthalmoscope is indispensable and some idea of how to test vision grossly is a requirement. The fact that a blow over the supraorbital ridge will sometimes affect the superior oblique muscle by concussion or other more severe injury, makes observation of the patient's ability to move the eyes together, an important part of the diagnostic examination. If both eyes work well together, and the fundi are clear, pupils equal, round, regular, reacting alike to light and accommodation; if the tension is normal to palpation; if no tenderness is noted; and if, in addition, each eye registers $^{20}/_{20}$ vision with the Snellen test charts, the chances are that no serious eye injury has occurred.

Testing of the intraocular tension by pressing on the upper lid over the eyeball rules out loss of vitreous or crushing of an eye, with a rupture of the sclera.

Even a ruined eye does not warrant neglect. The eye may be completely useless in function, and may never get back even a fraction of useful vision, but it must be prevented from harming the good eye. Sympathetic ophthalmia has been known to produce serious harm in an originally normal opposite eye.[3,4] Many regard this disease as a myth, and never learn that the unaffected eye must be watched for the slightest suspicion of photophobia, lacrimation, and beginning circumcorneal injection. These signs are possible indications for radical enucleation of the traumatized eye or other therapy. Sympathetic ophthalmia is not extremely rare.[3] Any wounds in the region of the cornea, through the sclera, or even behind the eye-ball itself may bring about this reaction in the good eye, sometimes resulting in its ultimate loss.

Traumatic corneal ulcers, which may result from family fights, are not apparent to the inexperienced observer. The spasm of the lids is often so great that many a doctor may say, "Use an icebag and come back tomorrow," if he cannot get the spastic lids open long enough to see much under them. If a fingernail has scratched the cornea in such a case, and the examiner does not know the importance of early correct treatment, infection may set in and an iritis, cyclitis, and possible panophthalmia get under way, guaranteeing complete loss of the eye.

Corneal ulceration should be suspected when there is great eyelid spasm after a direct injury. The diagnosis is simple after anesthetization of the conjunctiva with cocaine or other local anesthetic. The best way to see the ulcer is by the instillation of a drop of fluorescin followed by immediate irrigation of the conjunctiva with boric acid solution. If an ulcer is present, it will stain greenish yellow because of the affinity of the dye for the denuded surface of the cornea where the ulcer is present.

The treatment of corneal ulcer is simple when the diagnosis is prompt and when perforation through the anterior chamber has not occurred. Otherwise it is a most serious injury. The pupil should be kept dilated by atropine, and the eye covered; daily dressings with indicated medications are necessary.

If the trochlea is non-functioning and the superior oblique muscle is not taking part in the extraocular movements, the finding should be recorded but does not necessarily alter the immediate treatment. Later malfunction of the external ocular movements may be explained if the inability of the patient to move the eye upward and outward or downward and inward, is noted and believed to date from the original trauma to the face. Loss of ability to rotate the eye externally after trauma indicates injury to the abducens nerve, often sug-

gesting a basal skull fracture, and is commonly seen in supposedly mild head injuries.

Subconjunctival hemorrhages cause alarm in patients and may be serious indications of severe skull fracture. To differentiate the slight from the serious, a complete physical and neurologic examination as for suspected skull fracture is necessary. A complete eye examination will rule out other injuries inside the eye. Prognosis cannot be given until the patient states and proves his ability to see well. Subconjunctival hemorrhage either on the upper or lower part of the sclera is interpreted much more seriously if there is blindness in both eyes after an awakening from coma, or if a depressed skull fracture through the occipital areas, over the visual association centers, is also present, as occurs in rare instances.

Lacerations in the region of the eye, especially of the upper lid, can be very serious because (1) the likelihood of infection is multiplied many times with puncture wounds, and (2) there is the possibility of a sharp foreign body's having perforated either the eyeball or skull. A case has been reported where the patient himself did not realize that when he fell, he had run an ice pick an amazing distance into his head without serious immediate symptoms. A good history, accurate examination, and *x*-ray if doubt exists, will disclose the diagnosis and probable outcome.

NOSE INJURIES

The diagnosis of air in the subcutaneous tissues may suggest to the examiner that the paranasal sinuses have been ruptured. If a patient is struck on the nose, develops a nose-bleed, and then "blows up his eye" in trying to get the blood out of his nose, this suggests ethmoid fracture. Such a case should be treated as a potentially serious one, since the ethmoid is a bone of the skull and meningitis can follow such a fracture.

Often the patient who lacrimates considerably after an injury to the face, either blunt or lacerated, suggests to the examiner that his eye bothers him. Examinations with all due care, reveal no eye lesion. He may, however, have a ruptured nasolacrimal duct or an obstructed duct due to swelling of the inferior turbinate from the nose injury. A simple test to determine the patency of the duct is to drop a little mercurochrome on the lower eyelid of the lacrimating eye and then ask the patient to blow his breath gently out through the nose without much force and without compressing the other nostril. The dye can be seen on the handkerchief provided the injury has not entirely occluded the duct. This test is not to be tried when there is any nose hemorrhage. In many face injuries the test can be of aid in pointing out the intranasal swelling and a more serious condition than may have been at first suspected. The ever-present medicolegal aspects may thus be foreseen and obviated.

If a doctor makes a diagnosis of injury to the duct before the patient leaves the hospital and tells him what the outcome is likely to be, there is usually no trouble. If, on the other hand, the patient leaves the hospital believing that his lacrimating eye is supposed to improve and that there is nothing really wrong with it, he may later institute a suit for malpractice. The fact that many of these cases of injury to the nasolacrimal duct improve spontaneously is no excuse to neglect diagnosis.

WOUND SUTURE

In deciding which cases need suturing of lacerations and which may heal without sutures, the individual patient, the accessibility of good operative assistance and the judgment of the operator are all important.

Extensive, bleeding wounds certainly require suture. The indications for suturing multiple small laceration-contusions and perforations of the face from splintered glass, as in auto accidents, are less certain.

One must consider what functions will be lost if the face wounds are not repaired and whether a competent repair of the face lacerations will delay or hinder the progress of recovery of possible injuries elsewhere.

Normally, the most important facial functions are those having to do with (1) sight, (2) movements of all the muscles of facial expression, opening and closing the eyelids, (3) moving the eyes, (4) chewing, (5) lacrimating, and (6) salivating normally, (7) hearing (part of it has a bearing on the external ear), (8) breathing normally through the nose, and finally, (9) making a presentable "cosmetic" appearance.

Can a clean, small laceration across the nasolacrimal duct, at the inner canthus of one eye, a jagged wound of the forehead, and a gaping wound of the angle of the mouth—all be left untouched, unsutured and untreated because the patient is a little "dizzy" from the force of the accident? The answer is "yes," but the result would be poorer than a clean repair and accurate approximation by the best plastic technique. Reference to the injured functions in this case shows why suturing should be done.

To begin with, the forehead has possibly two functions impaired, that of taking part in facial expression (if the eyebrow cannot be elevated), and that of sharing in the appearance at rest. Next, closer examination of the inner canthus may show that without suture, the duct opening may not heal in its normal location, and that the tears may run down the face instead of into the duct. The gaping wound of the mouth may result in the loss of one or more of several functions: (1) normal "cosmetic" appearance at rest, (2) normal expression during talk, (3) normal appearance during eating, (4) normal closure of the mouth.

Everyone realizes the importance of such injuries when all the labels are put on the lacerations of this hypothetical case. Few take the trouble to make a detailed diagnosis of facial injuries when they are first seen. I feel strongly that facial injuries are emergencies, often of as much significance as a ruptured spleen or ruptured appendix. A ruptured spleen is difficult of diagnosis and of major importance as to life or death. However, where intra-abdominal hemorrhage from rupture of the spleen is suspected, the doctor is awake to his responsibility because of the imminent risk of death. I plead for preservation of the patient's facial *functions* for all the rest of his days. The difficulties may be undervalued at the first examination after injury.

Hemorrhage in neglected face injury cases is equally important. Secondary hemorrhages are common after improperly treated nose fractures, and especially in infected deep wounds, which are not sutured.

No patient with facial wounds should be put under observation in a hospital without an exact recording of the wounds as to depth and extent. Too often a patient is neglected because no one troubles to examine the wounds aseptically for fear of starting more bleeding and having to tie off more bleeding vessels. Such practice is entirely wrong. Every wound ought to be examined carefully, shaving the head if necessary. One must scrub the dried crusts off to find the end of the laceration and see where the depth of the skin cut leads.

It is better to stop bleeding on the examining table when a nurse can help with suture material than it is to stop a secondary hemorrhage later on, or watch a massive infection develop in retained blood clots which could better have been removed at the first examination and which could have been avoided in careful fashion by early suture.

Too many competent surgeons feel that a 2 inch cut surface is "small stuff," rather beneath their dignity. They put in only one or two stitches, if any. The careful plastic surgeon, on the other hand, may spend an hour or more repairing a 3 or 4 inch wound on the face. If the general surgeon feels that accepted methods of prevention of overscarring can be omitted from his treatment of lacerations, he should confine his surgery to the covered parts of the body (which today are becoming rather restricted). Long experience is the only safe guide by

which to limit the amount of suturing of wounds of the face.

Hemostasis comes first. I ask patients to take a deep breath and hold it, when this is safe, so that when I sponge in facial wounds, I can see evidence of venous ooze. It is then possible to clamp and tie.

I recommend starting to suture all face wounds when other more important diagnoses are under control (profound shock, severe hemorrhage, internal injuries, coma, skull fracture, etc.), continuing the suturing in any one wound only long enough to get good hemostasis and accurate approximation of the functioning structures, including the skin. Sometimes after I have repaired a number of face wounds I go over them, adding or removing a suture and putting in two or three more. Often I find I have taken a long time and at other times I find I have done a quick repair.

When the operator learns to classify immediate emergencies as different from future emergencies, he will do better by the patient. An ugly scar because of a contracture of face or eyelid which results in unemployment is a *future emergency*.

DIAGNOSIS

Where facial injuries exist, one must exclude in differential diagnosis skull fracture, concussion of the brain, dislocations of the cervical spines and one must consider possible later complications, gas bacillus infection, tetanus, rabies, and erysipelas; embolism, meningitis, sinusitis; tooth injuries, fractures of the upper jaw, fractures of the lower jaw, osteomyelitis, abscess formation in the lymph nodes, cellulitis, Ludwig's angina; loss of hair (eyebrows, hair line of scalp and scalp), retention of foreign bodies under the skin and resulting infections or swellings, and rarely, even staining of the tissues (as from the use of argyrol in the eye, gun-powder, dirt, carbon and other stains).

INFECTION AND HEALING

Cellulitis following injuries to the face is sufficiently common to suggest important hints toward making the diagnosis. Most commonly the inflammation begins on either cheek, or over the bridge of the nose, after fractures of the outer table of the frontal sinuses, rupture of the lateral cartilages of the nasal bones, or bad fractures of the nasal bones. It is also a common complication of a blow on the cheek of an individual suffering from chronic or subacute maxillary sinusitis. Diagnosis is easy when the case is advanced, but treatment is difficult and involved, requiring thorough study and individualization.

One case of infection of the upper lip developing into cellulitis; one infected venous thrombus leading to the base of the brain, resulting in fatal cavernous sinus thrombosis and general sepsis—can prove how important any wound of the face may be. The practice of many surgeons, doing as little to face wounds as is absolutely necessary where they suspect infection, is good teaching. Too much suturing or suturing without drainage can do harm. The possibility of introduction of organisms into the wounds must be kept in mind.

Infection following externally visible wounds of the face can be understood simply because of the obvious likelihood of introduction of foreign material by the object causing the wound. The surgeon should remember that possibilities for severe infection in such wounds will depend upon: (1) the amount and kind of germs introduced; (2) the amount of retained blood clot; (3) the duration of the time before suture and debridement repair are possible; (4) the extent of anemia from loss of blood; (5) the degree of manipulation; and (6) the amount of exposed tissues, and (7) the type of tissues exposed by the wound. The same principles of wound healing apply for face wounds, as in healing elsewhere in the body, with a few possible exceptions.

The most important of these is, when no infection occurs, that healing is more rapid over the stationary parts of the face than in the movable regions as, say, the

corner of the mouth, angle of the jaw, or upper lid. Further, facial wounds heal faster than do wounds in most parts of the body not having so rich a blood supply. The tip of the nose has excellent arterial supply, but a somewhat incompetent venous drainage when extensive lacerations are present. Considerable swelling therefore occurs postoperatively if there is only partial hemostasis. The drainage from the tip is poor when lacerations extend through it so far as to cut off easy lymphatic and venous drainage.This is also the case with the upper lip but not with all other parts of the face, for example vertical lacerations of the chin, cheeks or forehead. The eyelids often have remarkable swelling and distention with lymph and venous ecchymosis. Postoperative swelling is often lessened in such cases by continuous wet soaks of a saturated alum acetate solution.

Infection follows often in the path of tightly closed wounds about the eyelids, tip of nose, and upper lip, where post-operative swelling from edema, blood clot and serum develops. No germs from the outside need be introduced to get such unfortunate results. There are enough staphylococci in the sebaceous glands and on the face to predispose to infection.

Particular emphasis is needed with regard to gas bacillus infections around the face. They are rare but when present are rapidly fatal. They are seen sometimes from no worse wounds than severe, abrased contusions of the cheek and forehead, occurring usually after a fall in the street or on earth contaminated with animal excreta. The same is true of tetanus and all the organisms of the spore-forming, anaerobic group. It is, therefore, of the greatest significance when the patient tells that he was horseback riding and fell on a bridle path, or that he was struck down in the street and slid along on his face.

All wounds are likely to be infected about the face when they are characterized either by severity, by being of the puncture type or by having been subject to probable contamination. Fortunately many show remarkable healing in the worst cases imaginable, although others are often so rapidly fatal that the attendant cannot prevent rapid complications nor even foresee the likely demise. The poor outcome may be hastened by too much manipulation, tight suture, neglect of systemic hemorrhage, lack of drainage, too tight bandaging, too infrequent inspection of wounds; by neglecting to remove sutures to allow escape of serum and entrance of air when needed; and by the introduction of even slight infection at the time the original suture is performed.

Many doctors fall into habits in technique and that of not using gloves in suturing face wounds has been observed as late as 1939 in certain accident rooms of large hospitals. Certain ophthalmologists have never worn gloves for any of their eye operations. This seems grounds for malpractice suit, since it is common knowledge that the human skin cannot be entirely sterilized. The excuse given is that the touch is better when gloves are not used. They say too that the patient's resistance to infection is good about the eye.

The recognition of an obvious complication of an open face wound—meningitis—is not difficult if the doctor sees the meninges at the time he sews up the forehead and then watches the classical findings of meningitis develop. Sometimes, however, the wound in the coverings of the brain is not visible and hence there is delay in or a missed diagnosis.

If a doctor hears the words "compound fracture of the femur" he realizes that the condition is serious. Yet a tap on the nose, with no outside wound visible, may cause a compound fracture of the nasal bones because the air can reach the fracture through a break in the mucous membrane inside the nose. The same is true of many fractured lower jaws, upper jaws, loss of teeth from trauma, and also forehead and ear region injuries. External wounds seldom help in diagnosis. Therein lies the greatest danger of wrong treatment.

A bloody nose, bleeding ear, or bloody sputum after injury, may indicate "compound fracture."

A depressed fracture of the outer table of the frontal sinus with only slight swelling of the skin and subcutaneous tissues, should be understood as a "compound fracture," because air through the nostrils is in continuity with the broken bone. Why is this not more commonly taught and appreciated?

The diagnosis of "fracture of the outer table of the frontal bone" is likely to be more significant than some think, if the possibility of air-borne infection is realized by the route mentioned above. So, therefore, should the serious likelihood of infection of the meninges, with resulting meningitis, be remembered. No wound involving a compound fracture of the skull should be sutured except in the main operating room under strict technique.

CONCLUSIONS

There are no set rules by which a surgeon can be considered well trained to care for any complicated injury of the face unless he has had more than the usual training given to develop "general surgeons" in some institutions.

Too little is taught about the "functions" of the face and the importance of detailed diagnosis of injuries about the face. The reason for neglect in this teaching is the existence of the overlapping specialties of neurosurgery, eye, ear, nose and throat, oral, general, plastic, and other classifications of surgery.

Some of the conditions mentioned in this paper should lead to better recognition of the wide knowledge and great responsibility assumed by the doctor who accepts the care of facial injuries.

Education of laymen will soon enough remove from the inadequately prepared "specialists," their imagined prerogative of watchful waiting when real knowledge may often indicate immediate, and truly specialized, procedures. Injured people will eventually demand the services of the well trained surgeon.

SUMMARY

There has been presented some evidence that wounds of the face are sometimes neglected or inadequately treated because many details of diagnosis are not revealed by casual inspection of facial wounds. A few hints are given for the purpose of reviewing what may be obvious to the traumatic surgeon of wide experience. Exhaustive detail in diagnosis and treatment has been purposely omitted.

REFERENCES

1. Blalock, J. C. Early care of injuries. Elements of first importance. *Indus. Med.*, 7: 241–243 (May) 1938.
2. Druckmann, E. Retinal detachment and indirect trauma. *Ber. ü. d. Versamml. d. deutsch. ophth. Gesellsch.*, 51: 304–328, 1936.
3. Trowbridge, D. H., Jr. Clinical and pathological factors in 32 cases of sympathetic ophthalmia. *Am. J. Ophth.*, 20: 135–148 (Feb.) 1937.
4. Waldmann, B. Rhinogenic origin of sympathetic ophthalmia (identity with spontaneous serous iritis). *Am. J. Ophth.*, 20: 618–625 (June) 1937.

THE ADMINISTRATION OF VITAMIN B_1 BY INTRASPINAL INJECTION

OBSERVATIONS AND DEDUCTIONS

THEODORE R. ROBIE, M.D.

Consulting Neurologist, New Jersey Orthopedic Hospital

EAST ORANGE, NEW JERSEY

IN January, 1938 a United Press release appeared in the newspapers concerning a report read before the Pan-American Congress describing a new method of treating chronic neurologic disorders. The item was played up for news value and accorded the handling that most scientific or medical subjects receive when brought to the attention of the laity. For example, one metropolitan newspaper captioned the release with this headline: "Spine is Made Youth Fountain by Vitamin B_1," and the item itself informed readers that "the value of the method (spinal injection) has been proved clinically in a large number of different types of nervous disorders, decided symptomatic improvement being noted in cases of hopeless cancer, beriberi, multiple sclerosis, alcoholic neuritis, sciatica, von Recklinghausen's disease, and infantile paralysis."

Physicians, particularly neurologists, who failed to read the release or who were in the habit of acquiring information concerning the latest advances in medicine from other sources than the newspaper were soon made aware of their shortcomings. Practically all patients whom we were treating for multiple sclerosis had read the release and urgently requested that they be given this highly promising treatment at once. In this fashion our attention was directed to the intraspinal injection of vitamin B_1 for the treatment of chronic neurologic disorders and we ultimately evaluated the treatment in a series of cases under our observation with results which will be described later. Our group of patients had the following disorders: multiple sclerosis, poliomyelitis, encephalitis, and amyotrophic lateral sclerosis. All cases were chronic, and the majority were cases of multiple sclerosis. All patients receiving treatment were kept under observation for at least six months, and some for an even longer period of time.

Prior to our clinical evaluation of the administration of vitamin B_1 by intraspinal injection, the literature on vitamin B_1, particularly that which pertained to its clinical use, was surveyed and reviewed. It is not the purpose of this report to attempt a complete description of vitamin B_1 based upon the review of the literature, nor even to review the literature on the application and the value of vitamin B_1 in neurologic disorders. However, certain facts which in our opinion seemed pertinent to the evaluation might warrant mention.

Vitamin B_1 seems to be concerned in two important processes of the living organism: (1) oxidation in the tissues, and (2) the breakdown and utilization of carbohydrates by the body. Both processes may be more properly classified as portions of the general metabolism. Peters and his associates have developed these concepts in their discussion of the basic role of vitamin B_1 in the human economy. Vitamin B_1 deficiency produced in the experimental animal or encountered in the beriberi patient is characterized by excessive amounts of pyruvic acid or the pyruvates in the blood. Peters, in describing a study of pigeons suffering from B_1 deficiency, apparently regards the impaired powers of the central nervous system of these birds to carry out normal oxidation of the carbohydrates as the "biochemical

lesion" of B_1 deficiency, and significantly mentions the accumulation of the pyruvates in the blood of his experimental fowl and of beriberi patients. The biochemical lesion can be abolished in vivo or in vitro by the addition of crystalline vitamin B_1. Continuation of the deficiency in the experimental fowl is followed by convulsions of central nervous system origin. The condition of animals in experimental B_1 deficiency and that of patients suffering from beriberi (the manifestation of B_1 deficiency in human beings) are remarkably similar. Symptoms referable to impairment of the neural tissues are prominent features in both instances.

Beriberi, the condition caused by extreme or complete B_1 deficiency, is fortunately of rare occurrence in western countries. The question concerning the existence of B_1 deficiencies of less marked degree which could produce clinical manifestations is not so readily answered. The preponderance of evidence, however, indicates that subclinical B_1 deficiencies are not uncommon. The summary of the literature on vitamin B_1 by Wilder and Wilbur states that Cogwill estimates the daily B_1 requirement of the average adult to be about 300 international units; Harris and Leong estimate the daily requirement to be 250 to 500 international units. The summary continues that Baker and Wright reëmphasize the fact that vitamin B_1 is not abundant in most foods. Fresh foods, on an average, contain about 1 international unit per gram, but the content varies considerably and is further diminished during the preparation and cooking of food for human consumption. Finally the vitamin content of the diet does not wholly enter the body, as much of it may be lost during the process of digestion and absorption of food in the alimentary tract.

It seems reasonable therefore to state that the fairly high daily requirements of vitamin B_1 and the factors of varying food content, destruction during preparation of food for human consumption, and loss of the dietary vitamin B_1 during digestion and absorption, may work together to result in a higher incidence of mild to moderate B_1 deficiencies productive of clinical symptoms, than is commonly realized. The "biochemical lesion" of B_1 deficiency is majored in neural tissues, so many neurologic disorders, acute or chronic, might be due in part or entirely to B_1 deficiency.

The medical literature leaves no doubt but that vitamin B_1 is an important factor in certain nervous disorders and merits the title of "the antineuritic vitamin." Jolliffe, Colbert, and Joffe considered the relationship of diminished B_1 intake to neuritic symptoms to be definite. In their study of forty-two alcohol addicts, every alcoholic who developed polyneuritis had an inadequate vitamin B intake, while those whose intake was adequate did not develop polyneuritis. They believe "that alcohol has no direct toxic action on the peripheral nerves but that vitamin B_1 deficiency causes polyneuritis." Jolliffe and Colbert came to the same conclusions after a study of twenty-four alcohol addicts with polyneuritis. Seven patients on a borderline diet neither improved nor deteriorated. Eight patients on a moderate B_1 intake improved. Nine patients whose B_1 intake was approximately four times their estimated requirement improved rapidly and markedly. Two patients on the border diet responded quickly to the intravenous injection of crystalline B_1. Theobald treated neuritic patients in the last trimester of pregnancy with dietary measures; the symptoms in four were completely relieved by the addition of B_1 to the diet. The fifth apparently suffered from other vitamin deficiencies, and required A and D medication in addition to B_1.

Strauss and McDonald, on the basis of their experience with vitamin B_1 in four cases of polyneuritis of pregnancy, concluded that the prophylactic use of vitamin B_1 is indicated. Their first patient developed vomiting in the fourth month of pregnancy which increased in severity. After therapeutic termination of the pregnancy in the seventh month, a clear case of multiple

neuritis developed. The second patient also had multiple neuritis and vomiting of pregnancy. Miscarriage occurred and the patient grew steadily worse. Improvement followed the administration of iron and a diet rich in vitamins. The third patient had a typical polyneuritis of pregnancy with a macrocytic and hypochromic anemia. Improvement of the nervous disorder and of the blood occurred within ten days, and a healthy child was delivered at term. The mother was able to walk without difficulty shortly after the birth of the child.

Fouts, Gustafson, and Zerfas report a critical case of vomiting of pregnancy in which polyneuritis developed. Vitamin B therapy was instituted, and the patient soon showed definite improvement. The parenteral administration of vitamin B_1 is recommended in all such cases as a prophylactic against the development of polyneuritis.

Vorhaus has pointed out that the neuritides most often seen are the sciatic, sacroiliac, and shoulder-girdle group. Such cases are frequently associated with focal infection and improvement has followed removal of tonsils, teeth, etc. However, cures are few in comparison with disappointments over the results of such procedures. Vorhaus uses vitamin B_1 in these conditions and observed marked improvement in a large number of cases even in the presence of a focus of infection.

There are many other informative reports describing the use of vitamin B_1 in the treatment of polyneuritis, but a sufficient number have been cited to demonstrate the results obtained from B_1 therapy in this disorder. The value of vitamin B_1 or the status of B_1 deficiency in other neuropathies is not so definite or well defined. Wexberg, however, after studying forty-seven patients suffering from cranial, spinal, or peripheral nerve disease, stated that in all such cases evidences of vitamin B_1 deficiency should be looked for. He found definite or strongly suggestive evidence of B_1 deficiency in all of his cases, and secured definite improvement from the use of vitamin B_1 in patients with subacute combined degeneration of the cord, chronic progressive polyneuritis, and alcoholic polyneuritis.

Vorhaus, in an evaluation of B_1 therapy, stated that with the exception of beriberi, neuritis is the only clinical entity in which vitamin B_1 may be said to be of unquestionable value. Although studies of the relationship of vitamin B_1 and the susceptibility of experimental animals to herpes virus were inconclusive, Vorhaus used vitamin B_1 in postherpetic paresthesias and anesthesias and found that residual symptoms disappeared more quickly and that fewer patients had persistent anesthesias in the group receiving vitamin B_1 than in the untreated patients comprising the control group. Widenbauer reported vitamin B to be of value in the treatment of mild chorea and in a later paper described the use of vitamin B_1 by intramuscular injection in ten cases of spasmophilia. After one or two injections, the symptoms disappeared within twelve to seventy hours in eight of the ten cases.

Pfaffenberg and Mielke found that the cord symptoms in pernicious anemia were definitely relieved by large doses of vitamin B_1. The vitamin therapy was supplementary to the usual anti-anemia measures. These investigators, however, call attention to the fact that the neurologic symptoms in pernicious anemia have not been proved to be caused by neural lesions referable to B_1 deficiency.

In all of the clinical studies mentioned thus far, vitamin B_1 was administered either orally, intramuscularly, or intravenously. In reviewing the literature, reference to the intraspinal administration of vitamin B_1 was discovered, but consideration of the report was deferred until complete information regarding the influence of vitamin B_1 had been obtained, regarding its rôle in the physiology of the body, the lesions produced by B_1 deficiency (particularly in nerve tissues), and the value of vitamin B_1 in at least some of the neuropathies (by oral, intramuscular, or intravenous therapy). The data on these points, as has been

reported, warranted investigation of the intraspinal administration of vitamin B_1.

Friedeman apparently was the first to report the results obtained by the intraspinal administration of vitamin B_1. Two patients suffering from marked Korsakow's syndrome, severe dementia, and complete paralysis, and one patient with cerebrospinal syphilis and complete paralysis of the musculature of the extremities and abdomen, were given intraspinal injections of vitamin B_1. In all three cases, the patients regained muscular activity in about four months. Even the dementia improved so that the patients became completely oriented as to time and environment.

A dose of 500 international units of B_1 was given by epidural injection once a week. Later endolumbal injections were given. The time interval was gradually increased so that finally only one endolumbal injection was made in three weeks. The procedure was well tolerated. By-effects were observed only twice and consisted of nausea on the day of injection, and slight malaise and headache persisting for four days. In neither instance was it necessary to administer any drugs for relief.

Stern published a detailed study on the intraspinal administration of vitamin B_1. The cases treated included inoperable cancer, ten; von Reckinghausen's disease, one; multiple sclerosis, two; degeneration of the pyramidal system of unknown etiology, one; thrombo-angiitis obliterans with pregangrenous condition of feet, one; duodenal ulcer with pulmonary tuberculosis, one; alcoholic neuritis of the supraorbital nerve, one; neuritis of the sciatic nerve, one; cardiac decompensation with uremia and anuria, one; tabes dorsalis, one; hypertrophic spondylitis, two; osteoporosis of the spine, one; Paget's disease, one; intractable pruritus ani and vulvae, two; beriberi, one; and acute poliomyelitis, one.

The warranty for the intraspinal administration of vitamin B_1 according to Stern is that "avitaminotic nerve fibers seem to have an urgent hunger for this vitamin . . . which acts as a catalytic agent and which is essential for carbohydrate metabolism . . . after intravenous injection, the vitamin appears to be quickly eliminated in the urine, while after intraspinal injection, the elimination is found to be spread over a longer period of time." From his observations in these twenty-eight cases, Stern concluded that "many chronic or incurable conditions of the central and peripheral nervous system may respond favorably to the intraspinal subarachnoid injection of synthetic vitamin B_1. It should prove of particular value in cases of multiple sclerosis, encephalitis, syphilis and poliomyelitis."

Retarded elimination of vitamin B_1 would obviously be advantageous, as it would remain available for use by the nerve cells over an extended period of time. It has been shown that following oral, intramuscular, or intravenous administration, vitamin B_1 is so rapidly eliminated that correction of a pronounced deficiency requires many doses at frequent intervals.

Stern's favorable conclusions from his observations in the series of twenty-eight cases would indicate that the intraspinal administration of vitamin B_1 offers, among other advantages, retarded elimination. We were unable, however, to locate data that, in our opinion, demonstrated sufficient retardation of elimination as to be responsible for any material change in the clinical results. We were also unable to find information in the details regarding the patients' responses to treatment which enabled us to regard the therapy as being of value. Improvement in many of the cases could, in our opinion, be as well ascribed to other factors as to the intraspinal injections of vitamin B_1. For example, the marked improvement observed in the two cases of multiple sclerosis after four and five injections respectively could have been due to spontaneous temporary remissions which are known characteristically to occur in multiple sclerosis, or to psychic response (suggestion) on the part of the patient without organic improvement.

CHART I

Case	Sex	Age	History	Diagnosis	Treatment	Reaction	Result
1	F	55	First exam. 11/13/37. Onset 2 yrs. previous, pain in knees on walking. Unsteady on feet, and stiffness of legs. Urgency and incontinence.	Multiple sclerosis	6/1/38 10 mg. 6/8/38 10 mg. 6/15/38 30 mg. (intraspinally)	Severe headache after each treatment and more walking difficulty after last one; refused further injections.	Unimproved (subjectively worse).
2	F	14	First exam. 8/27/36. Spastic, dragging gait, extreme stiffness of legs. Typical neurologic findings.	Multiple sclerosis	3/30/38 10 mg. 4/13/38 30 mg. 4/20/38 30 mg. 5/4/38 30 mg. 5/11/38 30 mg. 5/25/38 30 mg. (intraspinally)	Severe headaches and felt weaker after each treatment. After a 2 wk. interval refused to continue after 6 injections.	Unimproved (must have support in walking).
3	M	35	First exam. 2/18/38. Onset 1½ yrs. previous with stiffness in left ankle growing steadily worse. Now had stiffness of both legs, and knees ache. Continuous fibrillary twitching of shoulder, girdle and pectoral muscles. Grew progressively worse during 3 months under treatment and had to discontinue.	Amyotrophic lateral sclerosis	3/23/38 10 mg. 3/30/38 30 mg. 4/6/38 30 mg. 5/4/38 30 mg. 5/11/38 30 mg. 5/18/38 30 mg. 6/11/38 30 mg. (intraspinally)	Unable to lift legs at all after some treatments, severe headaches after some. Discomfort so severe refused to come for treatment between third and fourth injections and on another occasion refused to come for 2 weeks.	Became progressively weaker—complete paralysis of extremities with incontinence (8/16/38).
4	F	54	First exam. 3/9/36. Onset one year previous with pain in legs and weakness in left leg and some loss of sensation of arms and hips, and tendency to give out when walking. Right foot dragged in walking. Numbness over right hip. Frequent backaches. Neurologic findings positive.	Multiple sclerosis	10 mg. daily from 3/9/38 to 6/10/38, then 3 times per week for 2 months, then every third day for one month. (intramuscularly)	None	Became progressively weaker (lost 5 lbs. during treatment).
5	F	35	First exam. 6/14/38. Pain and numbness in knees for 1 yr., worse past month. Could not walk straight, or manage feet right. Weak.	Multiple sclerosis	7/6/38 10 mg. 7/13/38 20 mg. 7/20/38 30 mg. 7/27/38 30 mg. 8/3/38 30 mg. 8/10/38 30 mg. 8/16/38 30 mg. 8/24/38 30 mg. 9/7/38 30 mg. 9/14/38 30 mg. 9/21/38 30 mg. 9/28/38 30 mg. 10/12/38 30 mg. 10/19/38 30 mg. (intraspinally)	Grew progressively weaker, with temporary minor remissions—in spite of taking the injections religiously every week. Refused to let herself complain of any discomfort, hoping for a cure.	Unimproved (unable to walk without support).

CHART I (*Continued*)

Case	Sex	Age	History	Diagnosis	Treatment	Reaction	Result
6	F	6	Born with bilateral clubfeet. Supernumerary right little toe. Only a trace of power in either calf and little in hamstrings. Extensors of hands and feet powerless.	Spina bifida or chronic poliomyelitis	1 mg. daily for 7 weeks—then 2 mg. daily for 7 weeks. (intramuscularly)	None	Grew worse (atrophy increased).
7	M	7	Onset at 2 yrs.—weakness of back with difficulty in getting up from prone position. Marked hypertrophy of calves of legs. In March 1938 was unable to walk. Entirely helpless and developing contractures.	Progressive muscular dystrophy	2 mg. daily from 3/7/38 to 6/-27/38. (intramuscularly)	None	Unimproved.
8	M	57	Claimed onset was sudden following a fright 4 months before. Pain in left leg first, with later spasticity and then weakness in legs and difficulty in walking. Very suggestible individual. Neurologic findings positive.	Multiple sclerosis	3/30/38 10 mg. 4/6/38 30 mg. 4/13/38 30 mg. 4/20/38 30 mg. 4/27/38 30 mg. 5/4/38 30 mg. 5/11/38 30 mg. 6/1/38 30 mg. (intraspinally)	Some headache after treatment and feet weaker for 2 days after each one.	Improvement in walking. Decrease in spasticity of legs. (Remission?)
9	M	36	Onset 3 years previous general weakness, particularly in legs, staggering gait for past year. Tired from waist down, loses balance on turning quickly. A most coöperative patient in completing all treatment no matter how unpleasant. Neurologic findings positive.	Multiple sclerosis	10 mg intramuscularly daily 2/25/38 to 4/13/38 then: 4/13/38 10 mg. 4/20/38 20 mg. 4/27/38 30 mg. 5/4/38 30 mg. 5/11/38 30 mg. 6/1/38 10 mg. 6/8/38 10 mg. 6/15/38 10 mg. 6/22/38 10 mg. 7/6/38 10 mg. 7/13/38 10 mg. 7/20/38 10 mg. 7/27/38 10 mg. 8/3/38 10 mg. 8/10/38 10 mg. 8/16/38 10 mg. 8/24/38 10 mg. 9/7/38 10 mg. 9/14/38 10 mg. (intraspinally)	Insomnia and throbbing pains in back followed all treatments of 30 mg. dosage, but 10 mg. did not cause discomfort.	Although anxious to be helped showed no sustained improvement after 48 daily intramuscular injections followed by 4½ months of weekly intraspinal injections. Legs twitch and pound in walking.
10	F	46	Onset 11 years previous after childbirth, with difficulty	Multiple sclerosis	7/2/38 10 mg. 7/28/38 10 mg. (intraspinally)	Terrible headache with vomiting and sweating	Unimproved. Refused to take further treat-

CHART I (*Continued*)

Case	Sex	Age	History	Diagnosis	Treatment	Reaction	Result
			in walking. Slowly getting worse. Unable to walk unassisted (6/27/38). Legs spastic. Other neurologic findings positive.			followed second intraspinal treatment. Symptoms persisted 5 days, followed by 3 weeks of prostration.	ments.
11	F	27	Onset 8 years before with gradually progressing pain and weakness of lower back followed by generalized body weakness and ataxia. Also emotional upsets, intention tremor of hands, urinary incontinence, diplopia and nystagmus, spastic, drags right leg, falls spontaneously. Neurologic signs positive.	Multiple sclerosis	3/23/38 10 mg. 3/30/38 30 mg. 4/6/38 10 mg. 4/13/38 30 mg. 4/20/38 30 mg. 5/11/38 30 mg. 6/8/38 30 mg. (intraspinally)	No reaction to 10 mg. but 30 mg. did cause persistent vomiting, headaches. Had to remain in bed. Because of such reactions long periods intervened between injections.	Grew progressively worse. Fell off chair, fractured thumb during third month of treatment. Now confined to bed, incontinent.
12	F	..	Onset 10 years before, gradually progressive spastic paralysis of legs. Now constantly spastic in extreme degree—bedridden.	Multiple sclerosis	Received 10 mg. on 2 occasions (one week interval). (intraspinally)	Severe reaction after each injection. Refused further treatments.	No improvement.
13	F	16	Condition present since birth. Markedly tremulous speech. Legs and arms extremely spastic, very unstable, wide-based gait. Makes grimaces spontaneously. Foot drop bilaterally with spontaneous right Babinski, and pains in legs for last year. Generalized body tremors exaggerated in Romberg test.	Spastic quadriplegia	5/13/38 to 6/15/38 given 10 mg. daily for one month. (intramuscularly)	None	No improvement.
14	M	38	Onset followed "grippe" in 1933. Partial numbness of both forearms with gradually increasing weakness of both, with tremor and hypertonicity. Masked fascies. Propulsive gait.	Post-encephalitic syndrome	3/23/38 10 mg. 3/30/38 30 mg. 4/6/38 30 mg. 4/27/38 30 mg. 5/4/38 30 mg. 5/11/38 30 mg. 6/1/38 30 mg. 6/8/38 30 mg. 6/15/38 30 mg. 6/22/38 30 mg. (intramuscularly)	None (Patient a stoic)	Growing worse. In third month felt right arm weaker. In fourth month cramps in arm. After seven months difficulty in drinking or moving lips.
15	M	47	Gradually progressive weakness of right upper extremity for 2 years. Shooting	Amyotrophic Lateral Sclerosis	10 mg. daily for nine weeks beginning 3/4/39. (intramuscularly)	None	No improvement. Fingers more painful. Pain in neck developed.

CHART I (*Continued*)

Case	Sex	Age	History	Diagnosis	Treatment	Reaction	Result
			pains, and pins and needles sensation in same member. Atrophy of muscles of interossei and lumbricales (right). Similar complaints to less extent in left upper extremity. Atrophy of both deltoids. Fibrillary twitchings in the pectoralis, biceps and triceps. Walks with wide base.				Spontaneous muscle twitchings frequent.
16	M	35	Bedridden spastic paralysis (quadriplegia) with incontinence. Duration 7 years. Marked speech and general bodily tremor, gradually progressive loss of sensation in hands. All neurologic signs positive.	Multiple sclerosis	3/8/38 to 3/18/38 10 mg. daily intravenously and 10 mg. intramuscularly. Then: 10 mg. intramuscularly daily for 7 weeks. Then 10 mg. first dose and thereafter 30 mg. intraspinally for 3 months.	Very coöperative. Minimized his discomfort but had one or two uncomfortable days after each intra-spinal treatment.	No improvement. Remains bedridden. Incontinence more frequent.
17	M	32	Onset gradual beginning 8 years before with facial palsy (right). Later diplopia. Weakness in legs with spasticity past 3 years, unable to get up and down stairs. Slow, deliberate speech. Tremors of legs (coarse) in walking. Feeling of generalized trembling. Neurologic signs positive.	Multiple sclerosis	1/31/38 to 2/10/38 10 mg. daily intravenously 10 mg. intramuscularly. 2/10/38 to 3/31/38 10 mg. intravenously daily. 3/31/38 to 6/8/38 30 mg. intraspinally at 5 day intervals (first dose 10 mg.).	Very coöperative. Minimized discomfort, but had repeated reactions of severe back pain following injections.	No improvement. Distinctly worse a year after starting treatment.
18	F	27	Gradually progressive weakness in lower extremities. Duration 8 years. Numbness after sitting, difficulty climbing stairs, occasional leg twitching. Neurologic signs positive.	Multiple sclerosis	10 mg. daily for 6 weeks begun 3/8/38. (intramuscularly)	None	No improvement.
19	M	29	Tremor in right arm developed 8 years after auto accident. Poliomyelitis 1½ years before, leaving weakness and atrophy of left hand, arm	Poliomyelitis Residual Paralysis (Possible encephalomyelitis)	10 mg. first dose and then 30 mg. weekly for 6 weeks. (intraspinally)	Severe headaches for 2 days—had to remain away from his work.	No improvement.

CHART I (*Continued*)

Case	Sex	Age	History	Diagnosis	Treatment	Reaction	Result
			and shoulder, constant tremor of right hand persists.				
20	F	36	Generalized pains like "toothache" particularly in hands and legs developed in April 1938, with some numbness. On April 21, neurologic exam. showed: bilateral foot drop, absent knee and ankle jerks complete loss of motor power (both legs) glove and stocking anesthesia, tremor and weakness both hands, positive Romberg. Ptosis right. History of excessive indulgence in alcohol.	Alcoholic polyneuritis	10 mg. b.i.d. intramuscularly for 6 weeks, then daily for 6 weeks. Subsequently 5 mg. orally b.i.d.	None	Numbness decreased in 10 days and disappeared in 20 days. Able to walk with help after 7 weeks and alone after 10 weeks. Jan. 1939—is attending dancing school weekly.

In view of the rôle of vitamin B_1 in the metabolism in the nerve tissues, the improvement which follows its use in the neuritides, the frequent occurrence of B_1 hypovitaminosis in many of the neuropathies, the nature of the nervous symptoms occurring in beriberi, and the favorable opinions of the investigators who had used and reported the intraspinal injection of vitamin B_1, we arranged for clinical evaluation of this procedure with the hope of confirming its value in the degenerative neurological disorders. The investigation was conducted in the Neurological Clinic of the New Jersey Orthopedic Hospital (Orange, New Jersey). Various types of organic disorders are seen in this Clinic which accepts patients from the northern half of the State. Vitamin B_1* was administered by intraspinal subarachnoid injections. The dose, the time interval between doses, and the duration of treatment are shown in Chart I. The table also includes data regarding the sex, the age, a digest of the pertinent facts of the history pertaining to the neurologic disorder, reactions (by-effects) caused by the treatment, and the results. It was planned to administer vitamin B_1 orally, intramuscularly, and finally intraspinally, interrupting the therapy at any point if improvement was such that further treatment seemed unnecessary. The patients were easily interested in the treatment. Although most of them had tried many different remedies without improvement during a period of months or years, they had developed a "grasping for a straw" philosophy, and were willing to try anything which offered hope. The complete progressive course of therapy could not always be applied in every case as is evident from inspection of the table. The reasons will be discussed later.

A series of twenty patients was started on the course of therapy which was planned to include the oral, intramuscular, and intraspinal administration of vitamin B_1 in each case. The following conditions were treated: multiple sclerosis, twelve; amyotrophic lateral sclerosis, one; postencephali-

* Acknowledgment is made of the courtesy of Hoffmann-La Roche, Inc., Nutley, New Jersey who provided generous supplies of berocca (synthetic vitamin B_1) for use in this study.

tic syndrome, one; spastic quadriplegia, one; poliomyelitis, one; progressive muscular dystrophy, one; spina bifida (or chronic poliomyelitis), one; and alcoholic polyneuritis, one. Complete recovery was obtained in only one case—the case of alcoholic polyneuritis. Three of the twelve patients with multiple sclerosis refused to continue treatment on account of the pain and discomfort caused by the intraspinal injections of vitamin B_1; no improvement was observed in these patients from the beginning of treatment to the time when they discontinued treatment. Seven of the patients with multiple sclerosis who continued with the treatment as long as requested failed to secure sustained improvement. Two of the patients with multiple sclerosis, having been treated with intramuscular injections of vitamin B_1 for a period of two to four months without improvement, were not given the intraspinal injections. Our observation of the seven patients who had received the injections without improvement made us reluctant to subject the patients to the discomfort, particularly since the intramuscular injections had effected no improvement.

In the remaining seven cases of various neurologic disorders, intensive vitamin B_1 therapy, administered intramuscularly or intraspinally, was not followed by sustained improvement.

Other investigators may be able to confirm the findings of Friedeman and Stern that the intraspinal injection of vitamin B_1 in chronic neurologic disorders brings about improvement. In our series of cases the procedure proved of no value. Deficiency of vitamin B_1 may also be shown in the future to be a factor, or even the basic cause, of multiple sclerosis or other degenerative neurologic disorders. Our results, however, indicate that if the nerve degeneration has reached the stage of irreversible change, return of motor or sensory function will not occur even though massive doses of vitamin B_1 are injected intraspinally over a long period of time. Considering the number of patients in our group and the youth of many of them, it would seem that there would be some in whom nerve degeneration had not reached the stage of irreversible change. In these cases (if vitamin B_1 deficiency caused the disorder) definite and sustained improvement such as return of function in a partially paralyzed arm or leg, should have occurred.

In the one case of multiple sclerosis in which improvement occurred, a number of factors have to be considered in evaluating this response. The patient, formerly a hardy and robust man, was most anxious to improve and therefore was extremely suggestible. The improvement, including the neurologic signs, was still apparent two months after conclusion of the intraspinal injections. After the passage of another two months, however, he went to another clinic where his condition was again diagnosed as a very evident case of multiple sclerosis. In our opinion, the improvement was probably due to a spontaneous and temporary remission, entirely unrelated to the intraspinal injections of vitamin B_1.

The intramuscular injections of vitamin B_1 caused no discomfort other than the pain usually experienced in any intramuscular injection from insertion of the needle. This part of the treatment, as well as the oral treatment, therefore, was not disturbing to the patients. The intraspinal injections, however, were painful even though a local anesthetic was used, and very frequently reactions such as headache or vomiting developed afterward and lasted as long as two days. Some patients refused to even start the treatment when these facts were made known to them by their fellow patients. Other patients, although they started treatment enthusiastically, could not be persuaded to continue treatment after experiencing one or two reactions. This was the experience with six of our patients.

Goodhart and Jolliffe, and Wechsler have established beyond question the fact that function can and frequently does return in paralytic conditions caused by a true vitamin B_1 deficiency. This response was

observed in the last case listed in the accompanying table. The patient, a 36 year old woman, had a typical case of so-called alcoholic polyneuritis (which in the future may be more properly named avitaminotic polyneuritis). Although a bed-ridden invalid previous to treatment, she recovered normal function of her paralyzed arms and legs and complete return of sensory function after less than three months of vitamin B_1 therapy administered intramuscularly. She is now healthy, normally ambulatory, and, according to most recent reports, taking dancing lessons regularly.

Due to the observations of McCormick, we included the case of poliomyelitic residual paralysis in our series. McCormick pointed out the similarities between poliomyelitis and beriberi and posed the question whether the susceptibility of children to poliomyelitis was related to decreased reserves of vitamin B_1 caused by increased physical activity in the summer months. If decreased vitamin B_1 reserves are responsible, this neatly explains both the greater severity and the higher incidence of the disease during the summer. While there is insistence upon an adequate intake of vitamins A, C, and D in the growing child, the concomitant need for vitamin B_1 is left in the background. The relatively recent synthesis of vitamin B_1 has made it readily available for therapeutic use and refocussed attention on its possible rôle in the resistance to poliomyelitis.

The disability in our patient was of one and one-half years' duration and therefore irreversible changes probably had occurred in the neural tissues. Other than the residual symptoms, the patient's condition was excellent. As was expected, the intraspinal injection of vitamin B_1 over a period of weeks failed to bring about improvement. Notwithstanding the results in this case, further intensive study of vitamin B_1 therapy in poliomyelitis seems warranted. Presumably, the vitamin should be administered intravenously or intramuscularly, immediately after the condition has been diagnosed.

SUMMARY

The widespread publicity given by the daily press to the inaccurate, optimistic accounts of medical research frequently arouses false hopes in those afflicted with the disorders which happen to be the subjects of the scientific investigation unfortunately exploited for sensational news value. Our attention was directed to the intraspinal injection of vitamin B_1 in the treatment of chronic neurologic disorders by patients who had such disorders and who had learned of the injections through the accounts in their newspapers. A survey of the medical and scientific literature indicated that there was a relationship between vitamin B_1 and metabolism in the neural tissues, that a "biochemical lesion" in the central nervous system was caused by B_1 hypovitaminosis, that the clinical manifestations of beriberi (absolute B_1 hypovitaminosis) included nervous symptoms now acknowledged to be remarkably similar to those seen in degenerative neurologic disorders, and that the use of vitamin B_1 in some disorders of the peripheral nerves, for example the neuritides, brings about improvement. The intraspinal injection of vitamin B_1, in the light of the survey, seemed to merit consideration, particularly since reports of improvement following such therapy appeared in the medical literature. The administration of vitamin B_1 by intraspinal injections (and other avenues as well) was evaluated in a group of patients suffering from chronic neurologic disorders. Our experience with this type of therapy has led to several conclusions.

CONCLUSIONS

1. Intraspinal injections of vitamin B_1 in a series of nineteen cases of chronic degenerative neurologic disorders and one case of alcoholic polyneuritis failed to bring about sustained improvement in the chronic degenerative disorders. The alcoholic polyneuritis apparently was cured by intramuscular injections of vitamin B_1; this

condition is recognized to be due to B_1 hypovitaminosis.

2. The intraspinal injections were very frequently followed by such severe reactions that a substantial number of even the most enthusiastic and hopeful patients discontinued treatment. Since the injections, in our experience, are valueless, discontinuation of treatment was a matter of no concern, except for the disappointment and the needless discomfort.

3. The lack of improvement indicates that B_1 hypovitaminosis is not the basic cause of the degenerative disorders and probably not even an important factor in their development or rate of progress.

4. The value of vitamin B_1 in some of the disorders of the peripheral nerves, for example the neuritides, suggests that it may prove of value in only those conditions in which nerve degeneration has not reached the stage of irreversible change. On this premise, treatment of poliomyelitis in its earlier stages with vitamin B_1 warrants further investigation. Poliomyelitis in the later stages or residual symptoms following an acute attack of poliomyelitis will probably not be improved by treatment with vitamin B_1.

5. Newspaper publicity of medical *research*, particularly in the field of therapeusis, is deplored. False hopes are aroused in patients who insist upon prolonged and frequently painful treatment of dubious or unproved value. The discontent and disappointment caused by failure of the treatment are a menace to the patient's general welfare.

REFERENCES

Peters, Rydin, and Thompson: Brain respiration. A chain of reactions as revealed by experiments upon catatorulin effect. *Biochem. J.*, 29: 53, 1935. The relation of pyruvic acid in brain to certain tissue poisons. *Biochem. J.*, 29: 63, 1935.

Peters. The biochemical lesion in vitamin B_1 deficiency. *Lancet*, 1: 1161, 1936.

Wilder and Wilbur: Diseases of metabolism and nutrition. Review of certain recent contributions. *Arch. Int. Med.*, 59: 512, 1937.

Harris and Leong. The excretion of vitamin B_1 in human urine and its dependence on the dietary intake. *Lancet*, 1: 886, 1936.

Baker and Wright. The vitamin B_1 content of foods. *Biochem. J.*, 29: 1802, 1935.

Jolliffe, Colbert, and Joffe. Observations on the etiologic relationship of vitamin B (B_1) to polyneuritis in the alcohol addict. *Am. J. M. Sc.*, 191: 515, 1936.

Jolliffe and Colbert. The etiology of polyneuritis in the alcohol addict. *J. A. M. A.*, 107: 642, 1936.

Theobald. Neuritis in pregnancy successfully treated with vitamin B_1. *Lancet*, 1: 834, 1936.

Strauss and McDonald. Polyneuritis of pregnancy. *J. A. M. A.*, 200: 1320, 1933.

Fouts, Gustafson, and Zerfas. Successful treatment of a case of polyneuritis of pregnancy. *Am. J. Obst. & Gynec.*, 28: 902, 1934.

Vorhaus. The present evaluation of vitamin B_1 therapy. *Am. J. Diges. Dis. & Nutrition*, 3: 915, 1937.

Wexberg. Diseases of the nervous system caused by nutritional deficiency. *Southb. M. J.*, 30: 334, 1937.

Widenbauer. Die Behandlung der Spasmophille mit krystallisiertem Vitamin B_1. *Monatschr. f. Kinderh.*, 70: 82, 1937.

Pfaffenberg and Mielke. Zur Vitaminbehandlung funikulaerer Spinalerkrankungen. *Klin. Wchnschr.*, 16: 919, 1937.

Friedemann. Epidural and endolumbal administration of vitamin B_1. *Schweiz. Arch. f. Neurol. u. Psychiat.*, Suppl., 39: 236, 1937.

Stern. The intraspinal (subarachnoid) injection of vitamin B_1 for the relief of intractable pain, and for the inflammatory and degenerative diseases of the central nervous system. Preliminary report. *Am. J. Surg.*, 39: 495, 1938.

Stern. Intraspinal (subarachnoid) injection of vitamins B_1 and C in acute poliomyelitis. *Clin. Med. & Surg.*, 45: 108, 1938.

Goodhart and Jolliffe. Effects of vitamin B (B_1) therapy on the polyneuritis of alcohol addicts. *J. A. M. A.*, 110: 414, 1938.

Wechsler. Multiple peripheral neuropathy versus multiple neuritis. *J. A. M. A.*, 110: 1910, 1938.

McCormick. Poliomyelitis: vitamin B deficiency a possible factor in susceptibility. *Canad. M. A. J.*, 38: 260, 1938.

NERVE BLOCK ANESTHESIA FOR FOOT SURGERY

HERBERT E. HIPPS, M.D., F.A.C.S.

Chief Orthopedic Surgeon, Crippled Children Hospital

MARLIN, TEXAS

THERE sometimes arises an occasion when some type of surgical procedure must be done on a foot and the condition of the patient will not permit the use of a general nor a spinal anesthetic and local infiltration will not suffice for the work to be done.

Such an occasion presented itself two years ago in a patient of mine. He had a compound lateral dislocation of the ankle joint, fracture of the medial malleolus, lateral malleolus and fracture of the neck of the astragalus. Due to the lateral position of the foot a very marked tension was placed on the posterior tibial nerve and artery so that the foot had to be reduced very soon to prevent gangrene from occurring. General or spinal anesthesia was out of the question due to a severe head injury and shock. The patient was semi-conscious and an anesthetic was necessary. Local infiltration obviously was insufficient for the magnitude of the work to be done.

A nerve block anesthetic was then administered according to the technique described below. The patient soon quieted down, his muscles relaxed and the reduction of the dislocation and fractures was easily accomplished. This same type of block anesthesia has since been done on eleven patients and the anesthesia has proved excellent in all. The operations for which this anesthetic was used include: five bunion operations; one triple stabilization (old man with fractured os calcis of long duration); one tendon suture; two infected plantar space abscesses; one removal of osteochondroma from metatarsal; one fresh os calcis fracture (Böhler reduction).

Anatomic Considerations. There are only two main nerves that supply sensation to the leg and foot. These are the tibial and saphenous branch of the femoral. The saphenous is purely cutaneous in its distribution and supplies a narrow area over the anteromedial aspect of the leg for about half the distance from the knee to the ankle. It would be hard to block with novocaine because of some variation in its position as it comes down out of the thigh. The tibial nerve divides into the posterior tibial and the common peroneal. The tibial and common peroneal have a very definite and unvarying location and can be easily found and injected. Both posterior tibial and common peroneal give off muscular, articular and sensory branches and these branches supply all of the muscles of the leg and foot and all of the sensation to the leg and foot except that small area supplied by the saphenous branch of the femoral.

If the tibial and common peroneal nerves were completely blocked with novocaine an anesthesia of muscles and skin should be present in the foot and in most of the leg. Because of the saphenous nerve distribution, surgery on the leg itself would not be possible, but surgery on the foot should be definitely possible.

Technique of Administration. The patient should first be placed on the operating table on his stomach. The knee is flexed, the flexion crease located, and the skin prepared. A needle is inserted into the skin in the flexion crease behind the knee at a point just a little to the outside or lateral to the center of the leg. The tibial nerve lies not exactly in the midline, but a very slight distance to the lateral side of the middle. Five c.c. of 2 per cent novocaine is injected just beneath the skin at this site. At this injection the needle point lies just beneath the skin, not in the skin and not penetrating the deep fascia. The medial cutaneous branch of the tibial often comes off higher than the other cutaneous or muscular

branches and comes down the leg more superficial to but parallel to the tibial and posterior tibial nerves. This injection, therefore, when placed in the subcutaneous tissue at this site, will block sensation coming through the medial cutaneous branch of the tibial.

The needle is inserted deeper without changing its location. Just after piercing the deep or popliteal fascia, the tip of the needle will be on or immediately adjacent to the tibial nerve. Fifteen c.c. of 2 per cent novocaine is injected here. It is not necessary to try to place the novocaine directly into the nerve trunk. If it merely surrounds the nerve it will be absorbed sufficiently to produce anesthesia, although if it can be injected directly into the nerve it will probably be a better and quicker anesthetic.

The common peroneal nerve has a constant, unvarying location as it curves downward around the head and neck of the fibula. A needle is inserted on the lateral or posterolateral aspect of the fibula just below the prominence of the head of the fibula. Most often when this is done the patient will feel a sharp electric shock run down the leg. Ten c.c. of 2 per cent novocaine is injected here.

The patient is turned over and the foot prepared for operation. Within ten minutes the foot is well anesthetised and the leg muscles relaxed.

DISCUSSION

There are very few contraindications. Some patients may be hypersensitive to novocaine, but I have never seen any unusual or bad reactions. Infections of the bone or skin or soft tissue at the site of injections should constitute a contraindication. Most patients will complain of feeling slightly dizzy for about fifteen minutes following the injection of this much novocaine, but the reaction always passes off within twenty minutes. The duration of the anesthetic is from thirty minutes to an hour. Sensation and muscle return have always been normal within two hours after the anesthetic is given and no bad results have ever been noted from its use.

This particular nerve block as presented here is not mentioned in available articles or texts on local or regional anesthesia, but because of its simplicity and ease of administration seems to have a definite field of usefulness in certain types of patients who cannot or who prefer not to have a general or spinal anesthetic.

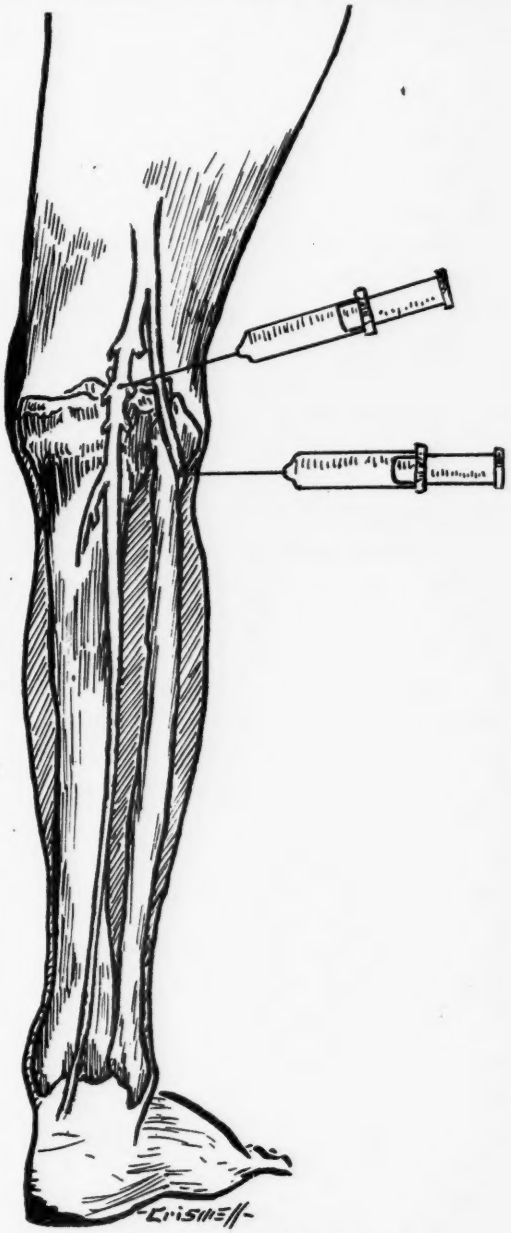


Fig. 1. Sites of injection.

SUMMARY

A new regional nerve block anesthesia is presented that is satisfactory in foot surgery

A METHOD FOR THE CONTROL OF POSTOPERATIVE PAIN IN HALLUX VALGUS OPERATIONS*

MAXWELL H. BLOOMBERG, M.D.

PITTSBURGH, PENNSYLVANIA

ONE of the annoying after-effects of the operation for hallux valgus is the pain, which may persist for five to six weeks. It is reasonable to expect a slow and rather painful convalescence since the operation is essentially an arthroplasty. To obviate the postoperative pain, it seemed worthwhile to crush the sensory branches innervating the region and thus produce a temporary anesthesia. This would not only add to the comfort of the convalescence, but would permit motion of the joint much earlier than is usually the case.

Since crushing of the nerve without ligature or section will allow reëstablishment of normal sensation within a reasonable period of time, there is no contraindication to this procedure providing due care is taken to avoid pressure on the anesthetized area during the first eight weeks. At the end of this time normal sensation is fully reëstablished.

Anatomy. The medial aspect of the metatarsophalangeal joint is innervated by a dorsal twig derived from a branch of the superficial peroneal nerve which anastomoses with one from the saphenous nerve. The lateral aspect of the joint receives its sensation through a trunk derived from the anastomosis of the medial dorsal cutaneous nerve to the great toe with one from the deep peroneal nerve to the first interosseous space. These nerves to the joint are readily exposed just proximal to the latter on either side.

Operative Technique. After anesthetization with ½ per cent novocaine and adrenalin, the joint is exposed by a curved dorsomedial incision. The superficial layers are dissected backward and laterally. The medial and lateral dorsal digital nerves are isolated and crushed for a distance of 1 cm. with a hemostat. Care is necessary not to sever them.

The technique for the reconstruction of the joint consists principally of chiseling off the greater part of the first metatarsal head, reshaping the new head, and interposing between the joint surfaces a long flap of capsule, the base of which is attached to the metatarsal bone. The wound is closed and the toe is then placed in a splint and strongly abducted by a pad between the first and second digits.

TABLE 1

Case	Age	Extremity	Pain	Return of Sensation, Weeks	Active Motion Instituted	Days in Hospital
I	46	Right	Absent	8	1 week	4
II	62	Right	Absent	7	5 days	4
III	52	Right	Absent	8	1 week	3
		Left		8	1 week	
IV	38	Right	Absent	8	1 week	4
		Left	Absent	8	1 week	
V	45	Right	Absent	9	10 days	4
		Left	Absent	9		
VI	46	Right	Absent	8	1 week	5
		Left	Absent	8	1 week	
VII	42	Right	Absent	7	1 week	5
		Left	Absent	7	1 week	
VIII	47	Right	Absent	9	1 week	7
		Left	Absent	9	1 week	
IX	44	Right	Absent	8	1 week	7
		Left	Absent	8	1 week	

Results. In nine patients a total of sixteen operations was done by the method described. (Table 1.)

* From the Orthopedic Department, Carney Hospital, Boston, Mass.

In all cases pain was absent throughout the entire convalescence and motion was possible much earlier than usual. Sensation returned within seven to nine weeks.

A roomy walking shoe with a straight last, wide toe and wide shank should be carefully fitted. It is of the utmost importance in the after-care to emphasize to the patient that wide shoes must be worn until sensation returns because of the danger of pressure sores.

CONCLUSIONS

1. A method which minimizes the pain after operation for hallux valgus is described.

2. Motion is instituted much earlier than usual.

3. The period of disability is definitely shortened.

4. This method may obviate the occurrence of hallux rigidus.

The terms spontaneous and pathological fracture are sometimes used as synonyms. It is an advantage to distinguish two groups of fractures in which the traumatic factor is unimportant: (a) spontaneous fractures where the bone is normal, and (b) pathological fractures where there is a pathological abnormality of the bone.
From—"Fractures and Other Bone and Joint Injuries" by R. Watson-Jones (Williams and Wilkins).

OSTEITIS DEFORMANS (PAGET'S DISEASE OF BONES)*

A REVIEW OF FIFTY-ONE CASES

EVERETT D. SUGARBAKER, M.D.

Clinical Research Fellow, Memorial Hospital

NEW YORK CITY

APPARENTLY as old as man himself yet comparatively new as a recognized clinical entity, osteitis deformans can no longer be considered a rare condition. The Neanderthal man has been suggested as a not unlikely example; it has been described in Egyptian mummies and in both its generalized and monostotic varieties in the rather recently uncovered remains of prehistoric American Indians. Moreover, pathologically similar lesions have been described in fowl, horses, and goats, and fairly typical cases have been described in monkeys, with convincing mineral studies. Notwithstanding so deep a background and so wide a scope it remained for Sir James Paget in 1877 to give clinical recognition to this disease, at first considered a rarity but with the development of diagnostic aids no longer so regarded.

Incidence. Schmorl, as a result of a series of post-mortem studies, quotes an incidence of 3 per cent in persons over 40 years, and at the Memorial Hospital, Coley states that they now routinely obtain skull plates on all patients over the age of 50 years seen in the Bone Tumor Clinic.

At the Henry Ford Hospital, from 1922 to 1937, in a total of 224,676 admissions, fifty-one cases were recognized, or one case of Paget's disease to every 4,500 admissions. Similar calculations from other clinics show an incidence of 1:3,000 to 1:16,000. In our own series only seventeen cases (33⅓ per cent) were recognized in the first half of the fifteen-year period and thirty-four cases (66⅔ per cent) in the remaining half. This is probably easily explained on the basis of rapid development of the *x*-ray as an aid in the diagnosis of wholly unrelated conditions (Paget's disease being discovered only incidentally) as well as its more frequent employment in the differential diagnosis of bone diseases.

Kay, Simpson and Riddoch, in a series of ninety-six cases (sixty-two collected from the literature and thirty-four of their own), give 55 years as the average age of diagnosis with a range of 39 to 78 years. They show a sex distribution of fifty-nine males and thirty-seven females. Gutman and Kasabach, in an analysis of 116 cases, show an equal number of each sex with a general age range of 25 to 79 years. In the former group there were two siblings and in the latter series four cases reported a familial incidence (four members in one case). In our own group there were thirty-one males, with an average age when diagnosed of 57 years, and twenty females with an average age of 59.5 years, the total average age being 57.7 years. However, the age of onset is difficult to determine because of the mildness and indefiniteness of the early symptoms. (Table 1.) None of our cases gave a history of any other member of the family having the disease. Our age range was 40 to 77 years. Cases occurring as early as the second decade of life (12 to 16 years)

TABLE 1

DURATION OF SYMPTOMS (WHEN FIRST SEEN)

Duration	No. of Cases	Average Age
Less than 1 yr	7	60.7
1–5 yrs	13	60
6–10 yrs	10	58.7
11 yrs	5	57

* From the Henry Ford Hospital, Detroit.

have been reported, Paget himself reporting one as early as 28 years of age. These should probably be regarded critically as they may well represent osteitis fibrosa. That Paget's disease and osteitis fibrosa cystica may fortuitously occur together seems reasonable to suppose, and Aub has recently reported several such cases.

Symptoms. Pain seems to be the most distressing feature of the condition, confined usually to the lower extremities, back, and head, and it is usually the first symptom to appear. The pain in the long bones is constant in type and is often marked long before any clinical alteration can be detected. At first it may be due to periosteal stretching but later it is due to the new axes of strain and stress with the attendant ligamentous stretching incident to the bending. This is confirmed by the observation that the pain is much more prone to occur in the bones of the lower extremities than in those of the arms, the bending of course being more pronounced in the former. Back pain probably depends on the vertebral softening with compression (gravity) of the vertebral bodies, and on the postural deformity with the consequent stretching of the various groups of spinal ligaments. That it not infrequently leads to a different type of pain, namely that due to nerve irritation, is shown by the fact that in several of our cases there were periods of agonizing sciatica. One of our patients with spinal involvement had several attacks of herpes zoster. Arthritis is often a complicating factor. The headaches in patients with skull involvement are difficult to evaluate correctly due to the frequency of complicating hypertension and arteriosclerosis. Bending of the long bones is the result of softening, plus gravity and muscle pull. Other less common and for the most part self-explanatory signs and symptoms need not be commented upon and will merely be listed in the charts. (Table II.)

Involvement. The skull, spine, pelvis, femur and tibia are the bones most frequently involved, in the order named. In the long bones the lesions generally first appear at the ends and later converge toward the midshaft. The periacetabular and sacroiliac regions appear to show the first signs of involvement in the pelvis. Apparently a slight predilection is shown by the disease for certain bones (i.e., ribs, scapulae, clavicles, etc.). This is also shown in groups of bones such as the vertebrae where the lumbosacral group predominates over the cervicodorsal. However, undue emphasis seems to have been placed on this, for when relative incidence is balanced by relative size of the bones this predilection becomes somewhat more apparent than real as an examination of most statistical tables, including our own, will show. (Table III.)

Table II

SIGNS AND SYMPTOMS (WHEN FIRST SEEN)

1. Skeletal:	
A. Long bones	
1. Deformity	20
2. Tenderness over or pain in	15
3. Increase in local heat	2
4. Overlying redness	1
5. Abnormal gait	4
B. Skull	
1. Deformity	7
2. Nerve deafness	5
Conduction deafness	1
3. Headaches	2
C. Miscellaneous	
1. Flaring of ribs and pelvis	2
2. Spinal deformity	6
3 Decrease in height or measurable bone shortening	8

We are able to present an unusually high percentage of monostotic cases, twelve in all, or 24 per cent. The average age of this group was 57.7 years. Only three of these had symptoms dating as long as five years; four cases were admitted as fractures and five cases were asymptomatic, the diagnosis being based entirely on the roentgenologic picture. The tibia was involved in six cases, the skull in two, the humerus in two, the sacroiliac area in one, and the radius in one.

With regard to the roentgenologic appearance of the lesions little need be said. A heterogenous confluence of areas of osteoporosis and osteosclerosis with a predominance of the former in the earlier

OSTEITIS DEFORMANS (PAGET'S DISEASE OF BONES)*

A REVIEW OF FIFTY-ONE CASES

EVERETT D. SUGARBAKER, M.D.

Clinical Research Fellow, Memorial Hospital

NEW YORK CITY

APPARENTLY as old as man himself yet comparatively new as a recognized clinical entity, osteitis deformans can no longer be considered a rare condition. The Neanderthal man has been suggested as a not unlikely example; it has been described in Egyptian mummies and in both its generalized and monostotic varieties in the rather recently uncovered remains of prehistoric American Indians. Moreover, pathologically similar lesions have been described in fowl, horses, and goats, and fairly typical cases have been described in monkeys, with convincing mineral studies. Notwithstanding so deep a background and so wide a scope it remained for Sir James Paget in 1877 to give clinical recognition to this disease, at first considered a rarity but with the development of diagnostic aids no longer so regarded.

Incidence. Schmorl, as a result of a series of post-mortem studies, quotes an incidence of 3 per cent in persons over 40 years, and at the Memorial Hospital, Coley states that they now routinely obtain skull plates on all patients over the age of 50 years seen in the Bone Tumor Clinic.

At the Henry Ford Hospital, from 1922 to 1937, in a total of 224,676 admissions, fifty-one cases were recognized, or one case of Paget's disease to every 4,500 admissions. Similar calculations from other clinics show an incidence of 1:3,000 to 1:16,000. In our own series only seventeen cases (33⅓ per cent) were recognized in the first half of the fifteen-year period and thirty-four cases (66⅔ per cent) in the remaining half. This is probably easily explained on the basis of rapid development of the *x*-ray as an aid in the diagnosis of wholly unrelated conditions (Paget's disease being discovered only incidentally) as well as its more frequent employment in the differential diagnosis of bone diseases.

Kay, Simpson and Riddoch, in a series of ninety-six cases (sixty-two collected from the literature and thirty-four of their own), give 55 years as the average age of diagnosis with a range of 39 to 78 years. They show a sex distribution of fifty-nine males and thirty-seven females. Gutman and Kasabach, in an analysis of 116 cases, show an equal number of each sex with a general age range of 25 to 79 years. In the former group there were two siblings and in the latter series four cases reported a familial incidence (four members in one case). In our own group there were thirty-one males, with an average age when diagnosed of 57 years, and twenty females with an average age of 59.5 years, the total average age being 57.7 years. However, the age of onset is difficult to determine because of the mildness and indefiniteness of the early symptoms. (Table 1.) None of our cases gave a history of any other member of the family having the disease. Our age range was 40 to 77 years. Cases occurring as early as the second decade of life (12 to 16 years)

TABLE 1

DURATION OF SYMPTOMS (WHEN FIRST SEEN)

Duration	No. of Cases	Average Age
Less than 1 yr	7	60.7
1–5 yrs	13	60
6–10 yrs	10	58.7
11 yrs	5	57

* From the Henry Ford Hospital, Detroit.

have been reported, Paget himself reporting one as early as 28 years of age. These should probably be regarded critically as they may well represent osteitis fibrosa. That Paget's disease and osteitis fibrosa cystica may fortuitously occur together seems reasonable to suppose, and Aub has recently reported several such cases.

Symptoms. Pain seems to be the most distressing feature of the condition, confined usually to the lower extremities, back, and head, and it is usually the first symptom to appear. The pain in the long bones is constant in type and is often marked long before any clinical alteration can be detected. At first it may be due to periosteal stretching but later it is due to the new axes of strain and stress with the attendant ligamentous stretching incident to the bending. This is confirmed by the observation that the pain is much more prone to occur in the bones of the lower extremities than in those of the arms, the bending of course being more pronounced in the former. Back pain probably depends on the vertebral softening with compression (gravity) of the vertebral bodies, and on the postural deformity with the consequent stretching of the various groups of spinal ligaments. That it not infrequently leads to a different type of pain, namely that due to nerve irritation, is shown by the fact that in several of our cases there were periods of agonizing sciatica. One of our patients with spinal involvement had several attacks of herpes zoster. Arthritis is often a complicating factor. The headaches in patients with skull involvement are difficult to evaluate correctly due to the frequency of complicating hypertension and arteriosclerosis. Bending of the long bones is the result of softening, plus gravity and muscle pull. Other less common and for the most part self-explanatory signs and symptoms need not be commented upon and will merely be listed in the charts. (Table II.)

Involvement. The skull, spine, pelvis, femur and tibia are the bones most frequently involved, in the order named. In the long bones the lesions generally first appear at the ends and later converge toward the midshaft. The periacetabular and sacroiliac regions appear to show the first signs of involvement in the pelvis. Apparently a slight predilection is shown by the disease for certain bones (i.e., ribs, scapulae, clavicles, etc.). This is also shown in groups of bones such as the vertebrae where the lumbosacral group predominates over the cervicodorsal. However, undue emphasis seems to have been placed on this, for when relative incidence is balanced by relative size of the bones this predilection becomes somewhat more apparent than real as an examination of most statistical tables, including our own, will show. (Table III.)

Table II

SIGNS AND SYMPTOMS (WHEN FIRST SEEN)

1. Skeletal:	
A. Long bones	
1. Deformity	20
2. Tenderness over or pain in	15
3. Increase in local heat	2
4. Overlying redness	1
5. Abnormal gait	4
B. Skull	
1. Deformity	7
2. Nerve deafness	5
Conduction deafness	1
3. Headaches	2
C. Miscellaneous	
1. Flaring of ribs and pelvis	2
2. Spinal deformity	6
3 Decrease in height or measurable bone shortening	8

We are able to present an unusually high percentage of monostotic cases, twelve in all, or 24 per cent. The average age of this group was 57.7 years. Only three of these had symptoms dating as long as five years; four cases were admitted as fractures and five cases were asymptomatic, the diagnosis being based entirely on the roentgenologic picture. The tibia was involved in six cases, the skull in two, the humerus in two, the sacroiliac area in one, and the radius in one.

With regard to the roentgenologic appearance of the lesions little need be said. A heterogenous confluence of areas of osteoporosis and osteosclerosis with a predominance of the former in the earlier

and of the latter in the later stages, with a tendency toward overgrowth and thickening taking place as an integral part of the process, characterizes the *x*-ray picture.

The pathologic appearance of the lesions both grossly and microscopically is so well known as to need no elaboration.

TABLE III
BONES INVOLVED

Bone	Totals	Author's Series	Packard, Steele and Kirkbude	Gutman et al.
Skull	154	23	49	82
Pelvis	136	25	21	90
Spine	137	24	31	82
Cervical	...	5	..	5
Dorsal		9	..	26
Lumbar		15	..	
Sacrum		13	..	51
Femur	124	21	44	59
One	...	11	4	
Both		10	40	
Tibia	105	21	50	34
One	...	14	3	
Both		7	47	
Fibula	20	6	10	4
One	...	5		
Both		1		
Patella	13	4	8	1
One	...	2		
Both		2		
Humerus	68	10	21	37
One	...	6	7	
Both		4	14	
Scapula	27	3	6	18
Clavicles	45	0	31	15
Ulna	19	2	12	5
Radius	29	3	19	7
Hands	11	2	8	1
Ribs	29	5	16	8
Sternum	7	0	7	
Face	10	1	9	

Biochemistry. Decalcification, new osteoid tissue formation and inorganic salt deposition take place simultaneously in Paget's disease. The decalcification is more apt to predominate in the earlier and more active stages of the disease, the inorganic salt deposition in the later and less active stages. Hence it is inevitable that conflicting reports concerning calcium, phosphorus, magnesium, and sulfur balances should have arisen (Locke, Hunter and DaCosta). The involved bones due to their large size show an increase in the total inorganic content, but the actual percentage inorganic content is less than normal.

Blood levels of calcium and phosphorus have quite generally been found to be within normal limits (Kay et al.; Gutman et al.). In our own series the blood calcium range was 9.0 to 10.6 mg. per cent, the blood phosphorus range was 1.72 to 4.54 mg. per cent with averages of 9.7 and 3.5 mg. per cent respectively. Any constant variations in the serum calcium depending on the stage of the disease (Belden and Bernheim) we were unable to observe.

The most recent additions to our knowledge of the biochemical changes taking place in Paget's disease have come from a study of phosphatase activity, begun by Kay in 1927. This substance, present in the plasma and enzymic in nature, possesses the property of hydrolyzing phosphoric esters such as glycerophosphate, hexosephosphate etc. The amount of this substance present is commonly expressed in Bodansky units, the normal value being 1 to 4 units.

The enzyme, insofar as has been determined, is a product of body cells in general but is present in the greatest concentration in the intestinal mucosa, kidney, and whole bone (Kay). In a few cases with a high plasma phosphatase concentration studied by Kay, the urinary concentration remained low. The excretion of this substance has been incompletely studied to date.

Bone lesions involving a fair portion of the skeleton are accompanied by a rise in the phosphatase content of the plasma. It has been found to be increased therefore in a number of conditions, including infantile and adolescent rickets (markedly increased) renal rickets, osteomalacia, osteogenesis imperfecta (normal or slightly increased), multiple myeloma (normal or slightly increased), osteogenic sarcoma, carcinoma with bone metastases, hyperparathyroidism and Paget's disease. Increased values have also been noted in diseases with

extensive liver damage. The highest values have been obtained however, in Paget's disease, they being higher than in osteitis fibrosa cystica for a comparable degree of bone involvement.

It is evident therefore that an increase in plasma phosphatase is the result rather than the cause of osteitis deformans, reflecting the cellular activity incident to osteogenesis. Consequently it is in itself of no value in differentiating Paget's disease from other conditions in which bone formation occurs. Coupled with roentgenographic evidence, however, it is a distinct aid in the diagnosis. In Paget's disease it may indicate the rate of development and is roughly proportional to the extent of involvement. Values as high as 120.6 units have been reported (Gutman) in patients with generalized bone involvement.

In our own group of cases phosphatase studies were carried out in sixteen cases and averaged 12.74 units. (Table IV.) There were four monostotic cases in which the values ranged from 2.62 to 19.22 units with an average of 8.97 units. The case in which the value of 2.62 units was obtained three years later showed 5.49 units. The average of the polyostotic group was 13.9 units with a range of 5.83 to 30.15 units, somewhat low as compared with other series. Five of the sixteen cases were initially seen because of pathologic fractures. Contrary to what might be expected, it could not be stated that the phosphatase readings in these cases were any higher than in others showing a comparable degree of bone involvement. The small size of this group however precludes any dogmatism.

Table IV
PHOSPHATASE

Age	Duration of Symptoms (Years)	Extent of Involvement	Phosphatase
57	3.0*	+	7.48*
53	None*	+	19.22*
48	None*	+	8.98
42	6*	+	5.13*
61	None	+	2.62* (5-5-34) 5.49 (1-30-37)
51	1	++	8.21
57	1	++	7.35 (5-12-34) 4.06 (12-12-36)
52	None*	++	4.45 (12-2-35) 7.2 (2-9-37)
55	5	++	6.24 (10-9-36) 9.8 (1-25-37)
69	1	+++	8.64
72	7	++	11.9
63	5	+++	11.3
58	5	+++	20.4 (1-7-35) 14.3 (1-28-37)
51	None	++++	31.5 (8-14-35) 14.6 (11-26-35)
43	5*	+++	35.6 (3-28-34) 24.7 (12-17-34)
64	30	++++	35.05 (11-2-34) 20.8 (3-3-37)

* Fracture.

Complications. Many of these patients present coincident neuropsychiatric conditions and numerous degenerative eye changes have also been reported, but one would be going a bit far afield to attempt to place the blame for these on the disease under discussion. It is generally felt that these are due rather to coincident degenerative arterial changes. Knaggs, who has carefully studied the skull changes, states that the increase in the thickness of the skull takes place almost entirely outwards, and that the foramina are not seriously contracted, though the regularity of their margins (particularly the foramen magnum) may be impaired. Cranial nerve palsies can occur from compression, however. The commoner resulting conditions are optic atrophy and nerve deafness. The latter is the more frequent. Lindsay and Perlman, in a review of this subject, conclude that Paget's disease does not produce impairment in hearing except with extensive disease in the bones of the skull including the temporal bone, and that though it is capable of producing conduction deafness, that of the inner ear type is much more characteristic.

Fractures of the pathologic type occur in about 15 per cent of the cases. There were ten patients (20 per cent) presenting this complication in our series, one patient

having sustained two and another three separate fractures. It is common experience that with proper treatment these fractures heal well, with abundant callus formation and usually within normal time limits.

Calculi were found in four cases, two biliary and two urinary. Goldstein and Abeshouse, who have reported six cases of urinary calculi in Paget's disease, state that it is an infrequent complication. Aub states that the formation of urinary calculi in Paget's disease is less frequent than in osteitis fibrosa. Moehlig and Murphy in a recent publication report the high incidence of 15.6 per cent but in a series of only twenty-six cases.

Sarcomatous degeneration in bones involved in the osteitic process occurred in two cases. In the first case the tibia alone was involved and in the second, sarcoma appeared first in the femur and later in the radius. The incidence has been variously quoted at from 2 to 9.5 per cent (Speiser; Higbee and Ellis; Packard, Steele and Kirkbride; B. Coley and Sharpe). Codman states that 14 per cent of all Paget's disease patients succumb to osteogenic sarcoma. This association of the two conditions has not been found to occur under the age of 50 years. The average age of onset is 54 to 57 years, with males predominating. Our own two patients were 58 and 60 years of age respectively and both were females. Coley and Sharpe state that the Paget's is reported present one to twenty years before sarcoma develops. Due to the difficulty in rightly determining the onset of Paget's they felt that an interval of ten to fifteen years is more likely. The significance of this association is further emphasized by their statement that they know of no benign giant cell tumor or endothelial myeloma occurring in a bone that was the site of a preëxisting Paget's disease. In one of our cases there was a history of Paget's for only nine months and in the other for ten years. In seventy-one cases of osteogenic sarcoma over 50 years of age which Coley and Sharpe report (twenty of their own) there was an association with Paget's in 28 per cent. Kolodny found that 5 per cent of all osseous sarcomas in the Bone Registry of the American College of Surgeons originated in bones involved in Paget's. In all cases of sarcoma of the skull there was preëxisting Paget's disease. Ochsner and Gage in thirty-one cases collected from the literature found more than one bone to be involved in eight cases (Coley and Sharpe in two cases).

The sarcoma is slightly different histologically from the usual uncomplicated osteogenic sarcoma in that it shows more giant cells and greater lymphocytic infiltration. The degree of malignancy is often greater also. Coley and Sharpe were unable to find any record of a patient surviving more than five years and Ochsner states that in all of the cases but one which he investigated death occurred within a few months. Our two cases lived only two and six months respectively from the time the diagnosis was made.

Etiology. Concerning the etiology of the disease little is known of a positive nature. That Paget himself considered it inflammatory in origin is indicated by the name, osteitis deformans, which he gave to it. Since then a heterogeneous group of factors among which are chronic absorption of intestinal toxins, lues, trauma, gout, rheumatism, malignant disease, trophic nervous disorders, heredity, and degenerative changes due to arteriosclerosis have been mentioned, all of which are probably incidental.

The disturbances in mineral balance accompanying Paget's disease, more particularly that of calcium, have been mentioned above. Whether they represent or are related to causes or to effects, however, can only be guessed at. The problem is not a simple one. The factors influencing calcium assimilation (Wagoner), the influence of magnesium intake (Kruse, Schmidt and McCollum), and vitamin D intake (Taylor and Weld; Watchorn; Pugsley and Anderson) not only on the calcium balance but also on the route of elimination deserve consideration.

The effect of the parathyroids on calcium metabolism is too well known to require

elaboration. Selye has been able to produce interesting bone changes in rats, characterized first by osteoporosis and later by osteosclerosis, by feeding large doses of parathormone. Bauer, Aub and Albright, as a result of their studies, suggest that hyperparathyroidism with its generalized stimulus for osteoclastic activity may enhance the localized unknown factor stimulating osteoclastic activity in Paget's disease. The interrelationship of calcium metabolism and thyroid function has also been established (Aub et al.; Hellwig; Klein; Pugsley and Anderson; Thompson; Hunter) and to complicate matters further the ability of thyroxin to sensitize the organism to parathormone might be mentioned (Stocker; Csépai and von Pellathy; Ask-Upmark). Moehlig, Murphy and Adler have attempted to correlate a high incidence of familial diabetes, familial tallness and obesity, and a high incidence of diabetic glucose tolerance curves with pituitary dysfunction.

However, in refutation it might be stated that patients with osteitis deformans generally exhibit normal appearing parathyroids; hyperthyroidism is an uncommon accompaniment of Paget's disease (Boothby and Sandiford; Wakely), amounting to only 6 per cent in this series; and Moehlig et al. were unable to produce any picture comparable to Paget's disease by the use of anterior pituitary extract in animals. In our own series only one case presented a family history of diabetes and although a family history of tallness and obesity was not regularly inquired into, these patients showed an average height and weight of 5 feet 6 inches and 152.4 pounds respectively for the males and 5 feet 1 inch and 145.5 pounds for the females, certainly not unusual.

Treatment. Treatment of a disorder as yet so little understood can be carried out with very little rationale and for the most part is merely symptomatic and palliative. Parathyroidectomy as well as the administration of parathormone have been tried with equally poor results. The administration of calcium, usually in combination with vitamin D, in some form has been used with varying success, one of our own patients having followed such a regime for ten years with only indifferent results. *X*-ray often relieves the bone pain and proper orthopedic treatment during the stage of softening prevents much of the otherwise ensuing deformity.

Recently Gill and Stein have reported interesting results by using a diet low in calcium and phosphorus and high in magnesium, the magnesium being given in the form of magnesium carbonate. They measure the efficiency of the treatment by a lessening of the calcium and phosphorous retention, by a decrease of the plasma phosphatase, by a decrease in the density and diameter of the long bones, and by a subsidence of symptoms. They state that it seems likely that the magnesium exerts a favorable influence by increasing the solubility of calcium and phosphorus and because it acts as a vasodilator. However, they neglect to state which phases of the disease have been benefited by this treatment nor do they present any numerical report of the progress of the phosphatase readings.

Berman, postulating that the first stage of Paget's disease is due to a hyperfunctioning of the parathyroids in relation to a relative deficiency of the adrenal cortex, has tried administering extract of adrenal cortex. Over a period of six to twelve months he reports cessation of all symptoms with a recession of weakness and deformity. In twelve cases phosphatase determinations at monthly intervals showed a steady fall, usually to about one-fourth to one-seventh of the initial level (never became normal, however). We have not as yet attempted this method of treatment but feel that it does merit a trial.

SUMMARY

1. Fifty-one cases of Paget's disease are presented, representing an incidence of one in 4,500 admissions. The proportion of males and females was in the ratio of 3:2. The average age of onset was about 58 years with a range of 40 to 77 years.

2. Pain is usually the first symptom to appear, is usually the most distressing feature of the disease and is largely confined to the lower extremities and back.

3. The skull, spine, pelvis, femur and tibia are the bones most frequently involved and in the order named.

4. The *x*-ray picture presents a heterogeneous confluence of areas of osteoporosis and osteosclerosis with a predominence of the former in the earlier and of the latter in the later stages with a tendency toward bone overgrowth and thickening.

TABLE V
INCIDENTAL LABORATORY DATA

Chemistry	No. of Cases	High	Low	Average
N.P.N.	21	41.6	12.6	32.5
Sugar	22	105	65	74
Uric acid	5	3.77	2.82	3.17
Urea	4	16.4	10.7	13.7
P.S.P.	11	68	28	57
Calcium	29	10.6	9.0	9.7
Phosphorus	29	4.52	1.72	3.5
Glucose tolerance	7			
Increased	1			
Decreased	5			
Normal	1			
B.M.R.	14			
Minus 10–15	1			
Plus-minus 10	8			
Plus 10–15	2			
Plus 30–40	3			

5. A negative calcium and phosphorus balance is generally present in the earlier and more active stages of the disease and a positive calcium balance in the later and less active phases, but the blood calcium and phosphorus levels are normal throughout.

6. The plasma phosphatase is usually increased in Paget's disease. It may indicate the rate of development and is roughly proportional to the extent of involvement.

7. Fractures occur in about 15 per cent of cases, but tend to heal well and within normal time limits.

8. Calculi are not common, occurring in four of the present series.

9. Sarcomatous degeneration is not uncommon, may occur in multiple foci and is generally rapidly fatal.

10. The etiology remains obscure. There is little reason for implicating either the parathyroids, thyroid or pituitary.

11. The treatment is mainly symptomatic.

REFERENCES

1. Albright, F., Aub, J. C., and Bauer, W. Hyperparathyroidism. *J. A. M. A.*, 102: 1276–1287 (April 21) 1934.
2. Ask-Upmark, E. Thyrotoxicosis and tetany. *Endocrinology*, 16: 369–396 (July-August) 1932.
3. Aub, J. C., Bauer, W., Heath, C., and Ropes, M. Studies of calcium and phosphorous metabolism; effects of the thyroid hormone and thyroid disease. *J. Clin. Investigation*, 7: 97–137 (April) 1929.
4. Bauer, W., Aub, J. C., and Albright, F. Studies of calcium and phosphorous metabolism; study of bone trabeculae as readily available reserve supply of calcium. *J. Exper. Med.*, 49: 145–161 (Jan.) 1929.
5. Belden, W. W., and Bernheim, A. R. Clinical and therapeutic considerations of osteitis deformans. *Radiology*, 18: 324–348 (Feb.) 1932.
6. Berman, L. Endocrine treatment of Paget's disease. *Endocrinology*, 16: 109–119 (March-April) 1932.
7. Berman, L. Studies of Paget's disease; effect of adreno-cortical extract treatment upon the blood phosphatase in Paget's disease. *Endocrinology*, 20: 226–227 (March) 1936.
8. Bodansky, A., and Jaffe, H. L. Phosphatase studies. III. *Arch. Int. Med.*, 54: 88–110 (July) 1934.
9. Boothby, W. M., and Sandiford, I. Summary of basal metabolism data on 8,614 subjects with especial reference to the normal standards for the estimation of the basal metabolic rate. *J. Biol. Chem.*, 54: 783–803 (Dec.) 1922.
10. Coley, B. L., and Sharpe, G. S. Paget's disease; a predisposing factor to osteogenic sarcoma. *Arch. Surg.*, 23: 918–936 (Dec.) 1931.
11. Csépai, K., and von Pellathy, S. Ueber die parathormone-empfindlichpeit des menschlicher Korpers mit besonderer Riecksicht auf die Basdowsche Krankheit und die Hyperthyreosen. *München. med. Wchnschr.*, 75: 813–814 (May 11) 1928.
12. Da Costa, J. C., Funk, E. H., et al. Study of the metabolism in osteitis deformans. *Proc. Path. Soc. Phila.*, 17: 29, 1915.
13. Da Costa, J. C. Paget's disease of bones. *S. Clin. North America*, 1: 47 (Feb.) 1921.
14. David, T. B., and Cooke, W. E. The supervention of osteogenic sarcoma in Paget's disease. *Brit. J. Surg.*, 25: 299–316 (Oct.) 1937.
15. Denninger, H. S. Paleopathological evidence of Paget's disease. *Ann. M. Hist.*, 5: 72–81 (Jan.) 1933.
16. Erdheim, J. Uber die Genese der Paget's Knockenerkrankung. *Beitr. z. path. Anat.*, 96: 1–60, 1935.
17. Gill, A. B., and Stein, I. Bone metabolism; its principles and relations to orthopedic surgery. *J. Bone & Joint Surg.*, 18: 941–956 (Oct.) 1936.

18. Gillian, G. J. Osteitis deformans. *Canad. M. A. J.*, 17: 60–63 (Jan.) 1927.
19. Goldstein, A. E., and Abeshouse, B. S. Urinary calculi in Paget's disease. *Am. J. Surg.*, 30: 359–368 (Nov.) 1935.
20. Gratz, C. M. Pathological fractures. *S. Clin. North America*, 10: 565–576 (June) 1930.
21. Gutman, A. B., and Gutman, E. B. Paget's disease: relative constancy of serum phosphatase levels over periods up to 2 years. *Proc. Soc. Exper. Biol. & Med.*, 33: 150–153 (Oct.) 1935.
22. Gutman, A. B., and Kasabach, H. Paget's disease. *Am. J. M. Sc.*, 191: 361–380 (March) 1936.
23. Gutman, A. B., Tyson, T. L., and Gutman, E. B. Serum calcium, inorganic phosphorus and phosphatase activity in hyperparathyroidism, Paget's disease of bone. *Arch. Int. Med.*, 57: 379–413 (Feb.) 1936.
24. Hellwig, C. A. Iodine deficiency and goiter. *Arch. Path.*, 11: 709–722, 1931.
25. Hunter, P. Studies in calcium and phosphorus metabolism in generalized diseases of bones. *Proc. Roy. Soc. Med.*, 28 (11): 1619–1638 (Oct.) 1935.
26. Kay, H. P. Phosphatases of mammalian tissues. *Biochem. J.*, 22: 855–866, 1928.
27. Kay, H. P. Plasma phosphatase in osteitis deformans and in other diseases of bones. *Brit. J. Exper. Path.*, 10: 253–256 (Aug.) 1929.
28. Kay, H. P., Simpson, S. T., and Riddoch, G. Osteitis deformans. *Arch. Int. Med.*, 53: 208–248 (Feb.) 1934.
29. Klein, J. E. Effect of calcium on storage of colloid in thyroid gland. *Ann. Int. Med.*, 7: 1080–1083 (March) 1934.
30. Klein, J. E. New concepts in etiology and treatment of thyroid disease. *Arch. Pediat.*, 53: 233–242 (April) 1936.
31. Knaggs, R. T. On osteitis deformans and its relation to osteitis fibrosa and osteomalacia. *Brit. J. Surg.*, 13: 206–237 (Oct.) 1925.
32. Kolodny, A. Bone Sarcoma. Chicago, 1927. Surgical Publishing Co. (quoted by Ochsner).
33. Kruse, H. P., Schmidt, M. M., and McCollum, E. V. Studies on magnesium deficiency. V. *J. Biol. Chem.*, 106: 553–572 (Sept.) 1934.
34. Lindsay, J. R., and Perlman, H. B. Paget's disease and deafness. *Arch. Otolaryng.*, 23: 280–287 (May) 1937.
35. Locke, E. A. Osteitis deformans (Paget's disease). In Oxford Medicine, 4: 408. New York, 1921. Oxford University Press.
36. Low, M. B., Wilson, R. O., and Aub, J. A. Phosphatase activity of the bones and kidneys in thyrotoxicosis. *Proc. Soc. Exper. Biol. & Med.*, 31: 447–450 (Jan.) 1934.
37. Moehlig, R. C., and Adler, S. Carbohydrate metabolism disturbance in osteoporosis and Paget's disease. *Surg., Gynec. & Obst.*, 64: 747 (April) 1937.
38. Moehlig, R. C., and Murphy, J. M. Attempt to produce Paget's disease by the use of anterior pituitary extract and parathyroid extract. *Am. J. Roentgenol.*, 34: 465–474 (Oct.) 1935.
39. Moehlig, R. C., and Murphy, J. M. Paget's disease. *Endocrinology*, 19: 515–522 (Sept.-Oct.) 1935.
40. Moore, S. Observations on osteitis deformans. *Am. J. Roentgenol.*, 10: 507–518 (July) 1923.
41. Ochsner, A., and Gage, I. M. Osteogenic sarcoma developing on osteitis deformans. *S. Clin. North America*, 10: 851–868 (Aug.) 1930.
42. Packard, F. A., Steele, I. P., and Kirkbride, T. S. Osteitis deformans. *Am. J. M. Sc.*, 122: 552–569 (Nov.) 1901.
43. Paget, J. Additional cases of osteitis deformans. *Proc. Roy. Med. & Chir.*, 9: 147, 1882.
44. Philips, H. B. Paget's disease. *J. Bone & Joint Surg.*, 8: 643–650 (July) 1926.
45. Pugsley, T. I. Effect of parathyroid hormone and irradiated ergosterol on calcium and phosphorus metabolism in rat. *J. Physiol.*, 75: 315–328 (Nov. 5) 1932.
46. Pugsley, T. I., and Anderson, E. M. Effect of desiccated thyroid, irradiated ergosterol and ammonium chloride on the excretion of calcium in rats. *Biochem. J.*, 28: 754–758, 1934.
47. Pugsley, T. I., and Anderson, E. M. The effect of administration of calciferol on increased calcium excretion induced by thyroxine. *Biochem. J.*, 28: 1313–1315, 1934.
48. Rabinowitch, I. M. Metabolic studies in a case of osteitis deformans. *J. Nutrition*, 5: 325–346 (July) 1932.
49. Roberts, R. E., and Cohen, M. J. Osteitis deformans (Sect. electro therapeutics) *Proc. Roy. Soc. Med.*, 19: 13–40 (March) 1926.
50. Selye, H. On stimulation of new bone formation with parathyroid extract and irradiated ergosterol. *Endocrinology*, 16: 547–558 (Sept.-Oct.) 1932.
51. Schmorl, G. Über Osteitis deformans Paget. *Virchows Arch. f. Path. Anat.*, 283: 694–751, 1932.
52. Speiser, F. Sarkomatose Entastung bei Osteitis deformans. *Arch. f. klin. Chir.*, 149: 274–295, 1928.
53. Stocker, H. Thyroxin and Parathormone bei postoperativer Tetanie. *Deutsche Ztschr f. Chir.*, 222: 357–373, 1930.
54. Taylor, N. B., and Weld, C. B. Mobilization and excretion of calcium following overdosage with irradiated ergosterol. *Brit. J. Exper. Path.*, 13: 109–127 (April) 1932.
55. Thompson, J. Influence of calcium on thyroid gland of albino rat. *Arch. Path.*, 16: 211–225 (Aug.) 1933.
56. Wagoner, G. Present views of calcium-phosphorus metabolism. *Am. J. M. Sc.*, 191: 511–515 (April) 1936.
57. Wakeley C. P. G. Paget's disease of the humerus and clavicle, associated with Graves' disease. *Proc. Roy. Soc. Med.*, 26: 47–48 (Nov.) 1932.
58. Watchorn, E. Irradiated ergosterol and phosphorus metabolism. *Biochem. J.*, 24: 1560–1563, 1930.
59. White, E. P. G. Osteitis deformans in monkeys. *Arch. Int. Med.*, 30: 790–796 (Dec.) 1922.
60. Woodard, H. Q., and Higinbotham, N. L. The correlation between serum phosphatase and roentgenographic type in bone disease. *Am. J. Cancer*, 31: 221–237 (Oct.) 1937.

A SIMPLIFIED METHOD FOR PRODUCING A WINDOW CAST

BENJAMIN I. GOLDEN, M.D.

Surgeon, Golden Clinic

ELKINS, WEST VIRGINIA

MAKING a window in a plaster cast has always been a time consuming procedure, and frequently, the effort to protect the wound permitted an area of enlarged cast to allow an undue amount of edema. If padding had to be used, that which remained after the window was constructed quickly soiled, and thus an early change of cast was necessary. If the window was large, extra thickness of plaster was necessary to reinforce the remaining part, thus producing a heavy unwieldy cast.

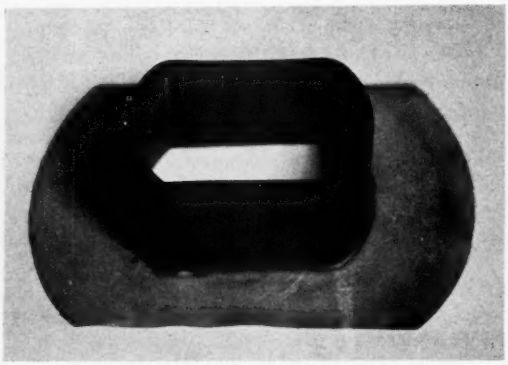


FIG. 1. The rubber collar is extremely heavy, but pliable. The flange is very thin and easily moulded to the part.

In an effort to simplify this procedure, we present a rubber collar with a thin flange which fits directly over the wound and allows the wet plaster to be applied around the collar, thus constructing a window at the time of the application. The rubber will not adhere to the plaster, and by forcefully removing the collar with an upward pull before the plaster is completely set, there is produced a slight elevation around the edges of the window which permits the dressing gauze to be placed within the cast. This manipulation does not loosen the cast in its full diameter. After the collar has been withdrawn the edges can be rounded or moulded and, since a smooth edge will not absorb as rapidly as a rough cut edge, it will remain clean longer.

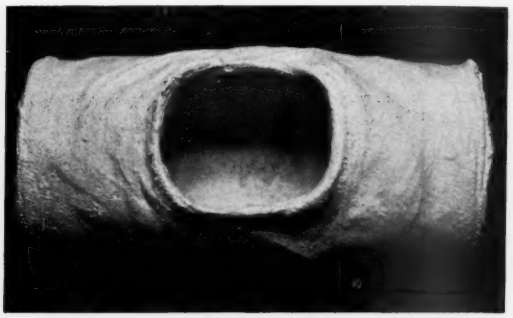


FIG. 2. A moulded window demonstrating the smooth edges.

Should it be desired, the rubber flanges can be made adherent to the skin with collodion, so that the rubber collar can be left intact after application thus permitting the use of wet dressings. Window casts made with this collar are applied directly to the skin.

The application is simple where a small window is necessary, but with the larger collars the plaster bandage is applied by carrying it back and forth, from lateral edge to lateral edge. When the proper thickness has been acquired a few longitudinal strips are laid down. On the removal of the collar the up-turned edges are folded outward and smoothed.

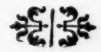
The upright edges of the collar are sufficiently strong to allow manipulation without folding, while the flanges are thin enough to permit conformation to the part. The whole collar is made of live rubber. Plaster does not stick to this material. After use the collar can be cleansed with water and kept as any other rubber equipment.

We are indebted to the American Anode Company for constructing the experi-

mental collars. They can be obtained in any length or width. For the average wound a 2 inch width gives ample working space. Due to the raised area immediately surrounding the window the space need not be excessively large as in the case of the cut window or where a box top is used.

The advantages of the rubber collar are:

1. Ease of application.
2. Ability to apply a form fitting cast without padding.
3. The application of a light weight window cast without weakened areas.
4. Early moulding of the edges of the window, thus assisting in keeping the cast clean longer.
5. Walling off of the wound by leaving the collar intact permitting freedom of treatment.



The victim of a spinal injury complicated by paraplegia must never be lifted by the shoulders and hips in such a way that the spine sags between the points of support. . . . The face down position is relatively safe, for the spine is then hyperextended, and in most spinal fractures hyperextension reduces the displacement and relieves cord compression.
From—"Fractures and Other Bone and Joint Injuries" by R. Watson-Jones (Williams and Wilkins).

BLADDER DISTURBANCES IN DISEASES OF THE SIGMOID*

C. J. E. KICKHAM, M.D. AND T. F. P. LYONS, M.D.

BOSTON, MASSACHUSETTS

OBSERVATIONS at the Carney Hospital during the past several years have emphasized the importance of urinary tract manifestations in diseases of the sigmoid. These observations prompted the writers to review the cases of diverticulitis and malignant disease of the sigmoid admitted to the hospital between January 1, 1928 and January 1, 1938.

Bladder disturbances in these disease entities are logical to expect, in view of the anatomic proximity of the two organs. Vesical involvement may be the result of direct extension and actual invasion or may be due to external pressure on the bladder by the pathologic process. A factor of significance is the relative fixity of the bladder which makes it an accessible locus for the spread of disease from the relatively mobile sigmoid. This likewise explains in great measure the infrequency of large bowel invasion by primary malignant disease of the bladder even though actual peritoneal extension is frequently observed.

Manifestations of urinary tract involvement in sigmoid disease show a preponderance in the male. The protective influence of the uterus, which rests between the bowel and the bladder in the female, functions as an impenetrable barrier so that pathologic communication between the two organs becomes anatomically quite difficult. Another factor is that diverticulitis and malignant disease of the sigmoid, the most common offending diseases, occur more frequently in the male.

A review of the literature reveals that the first reference to the subject appeared in 1843 when Barbier de Mille discussed the operative intervention of vesico-intestinal fistula. Isolated reports appeared at variable intervals thereafter until 1909 when Parham and Hume reviewed the literature and presented an excellent treatise on the subject. Chute, Cunningham, Keefe and Hinman have contributed to the literature since that time. In 1935, Colby reported definite adhesions to the bladder in 13 per cent of a series of seventy-seven cases of malignant disease of the sigmoid. In 1936, Higgins reviewed 328 cases of vesico-intestinal fistula from the literature and added thirty-five cases from the Cleveland Clinic. He found that ninety-six cases were secondary to diverticulitis of the sigmoid and thirty the result of sigmoid malignancy.

Our study disclosed that sixty-six patients with diverticulitis of the sigmoid were admitted to the Carney Hospital over a period of ten years, thirty-two of whom were males and thirty-four females. The youngest was 31 years of age and the oldest 85. Thirty-six patients, or 55 per cent, had definite urinary complaints; eighteen associated their symptoms with those referable to the large bowel. The chief complaint was in twelve instances consistent with pathology in the urinary tract. Pain simulating left ureteral colic was encountered in two patients, probably the result of impingement of the left ureter by an inflamed diverticulum or abscess. Urinary frequency, hematuria, terminal dysuria, urgency and gas and feces in the urine were other complaints. Localized scrotal pain was the only symptom in two instances. Definite vesico-intestinal fistulae were encountered in three patients. Bladder inspection was made in seven individuals.

It is worthy of note that two of our medical colleagues are subject to intermittent attacks of diverticulitis. They have experienced definite vesical disturbances consisting of urgency, frequency and severe urethral pain at the end of urination,

* From the Urological and Surgical Services, Carney Hospital, Boston. Read at the Diamond Jubilee Celebration of the Carney Hospital on May 17, 1938.

probably the result of the contiguity of an inflamed diverticulum.

In our series there were thirty-seven case of malignant disease of the sigmoid, ranging in age from 24 to 76 years. There were sixteen males and twenty-one females. Subjective urinary complaints were present in eight instances. The presenting complaint was referred to the urinary tract in one instance. There were two vesicointestinal fistulae. A comparison of these findings reveals that diverticulitis played a greater rôle in the development of urinary symptoms than carcinoma.

The intimate relationship between the field of the urologist and the problems of the gastroenterologist and abdominal surgeon are here illustrated. Chute has written that "long-continued, left-sided abdominal pain or discomfort, followed by bladder irritation as the diverticulum becomes attached to that organ, and finally the occurrence of the opening of the diverticulum into the bladder with apparent anuria and followed by the presence of gas and feces in the bladder at times, is the classical picture of diverticulitis with vesico-intestinal fistula."

Recognition of diverticulitis in the early stages is quite difficult as in most instances, it is insidious, obscure, and practically symptomless. There may be some constipation or lower left abdominal discomfort to which the patient may attach no real significance. As the disease progresses, especially during an acute exacerbation, pain may become more marked and a complaint of tenderness on pressure may be present. Objective findings of muscular spasm and the palpable evidence of a mass may make the diagnosis less difficult. The clinical features may be so distinctly urologic that the victim may first consult a urologist because of symptoms of vesical irritation. The consultant may find that the symptoms are out of proportion to the findings or the study of the urinary tract may be absolutely negative. In this group, the fact that an early extra-urinary lesion may reflect itself in the urinary tract must be kept in mind. Disease in the sigmoid must not be overlooked. A careful history of bowel habit must be obtained and special diagnostic procedures carried out to exclude pathology in the sigmoid as the chief factor in the patient's complaints.

The severity of the urinary tract manifestations depends upon the type of pathology present. In diverticulitis, as the inflammatory process develops and the sac becomes distended by acute inflammation, a peridiverticulitis develops. If it rests in proximity to the bladder, disturbances of urination may result. If the mass subsides spontaneously, as it does in many instances, the clinical signs and symptoms may regress or disappear. In the chronic recurrent type, the vesical disturbances may recur. If the process progresses to definite suppuration, the development of a fistula between the two organs is imminent. Attention may not be directed to the presence of a fistula until long after the communication has been established, as the opening may be so minute as to preclude the possibility of fecal and gaseous passage into the bladder cavity. In most individuals, however, an acute inflammatory reaction is set up in the bladder and the patient presents the symptoms of an acute cystitis and in some instances the clinical picture of pyelonephritis with chills, fever, and toxemia. With the appearance of a definite open channel or tract, gas and fecal material are passed through the urethra or the patient may develop a pseudo-anuria with the passage of urine per rectum. The fistulous tract may be a direct communication or a long tortuous sinus. The latter is observed more frequently in the inflammatory type while the direct communication is more characteristic of the malignant group.

Secondary vesical involvement by malignant disease of the sigmoid may result from direct invasion of the bladder by the cancerous process and ultimate fistula formation or be due to the development of an inflammatory process around the tumor which becomes adherent to the bladder, as in diverticulitis, and finally may form a fistula.

The clinical recognition of this group depends on the proper evaluation of the signs and symptoms plus the physical findings correlated with special diagnostic measures including cystoscopy, proctoscopy and *x*-ray studies. The cystoscopic picture varies with the extent of the disease, the presence or absence of fistula and the sex of the subject.

Distortion of the left lateral wall of the bladder due to extravesical pressure is the earliest manifestation of urinary tract disturbances. This finding must be evaluated with care, particularly in the female as other causes must be excluded. A pelvic examination must be made to exclude pathology in the female genital system. As the process advances toward the bladder and becomes adherent to it, the bladder picture is altered. Localized areas of increased vascularity with submucosal hemorrhage followed later by edema are noted. In the presence of tumor the reaction in the bladder is more localized and as further invasion takes place a definite tumor may be seen projecting into the bladder. There may or may not be ulceration.

The end stage of this whole process as far as the bladder is concerned is the development of a fistula. In the earliest stage it may be so minute that its cystoscopic recognition is not only difficult but in many cases impossible.

Primary malignancy of the bladder must be excluded in this group of cases and in some instances biopsy may be necessary. The differential diagnosis between diverticulitis and malignant disease is often extremely difficult. It is our impression that the vesical reaction in the former is more fulminating than that due from extension of cancer. Barium enema is the important diagnostic procedure. In a definite percentage of cases preoperative diagnosis may be impossible and surgical exploration alone may solve the problem. Delineation of the fistulous tract may be obtained in some instances by left lateral cystogram or by barium enema, and its presence actually confirmed by finding dye, such as methylene blue, in the rectum or stool following its injection into the bladder, or the presence of barium in the bladder following a barium enema.

The treatment of the urinary tract complications in diseases of the sigmoid should be directed to the eradication of the primary disease. The type of therapy medical or surgical, is dependent upon the pathology present and the stage in which it is encountered. General measures should be instituted to combat urosepsis and maintain renal values. If a fistula is present, the fecal stream should be diverted by colostomy to protect the upper urinary tract from further infection. Following this procedure, the inflammatory process (if present) may subside and the spontaneous closure of the fistula may occur. Later plastic procedures, however, often are necessary. Excision of the primary disease should never be carried out during the acute stage.

SUMMARY

Cases of diverticulitis and malignant disease of the sigmoid admitted to the Carney Hospital over a ten-year period are reviewed. The high incidence of vesical disturbances is emphasized. The frequency of such disturbances is shown to be greater in diverticulitis than in malignant disease. The clinical manifestations may be distinctly urologic in this group. The close coöperation among the urologist, the abdominal surgeon and the gastroenterologist in the management of disease of the sigmoid is essential.

REFERENCES

1. Barbier de Mille. Cited by Parham and Hume.[2]
2. Parham, F. W., and Hume, J. Vesico-intestinal fistulae. *Ann. Surg.*, 50: 251, 1909.
3. Chute, A. L. Diverticulitis of the sigmoid as a source of bladder irritation. *J. Urol.*, 21: 13, 1929.
4. Cunningham, J. H. Rectovesical and enterovesical fistulae. *Surg., Gynec. & Obst.*, 21: 510, 1915.
5. Keefe, J. W. Diverticulitis of the sigmoid or pelvic colon with sigmoidovesical fistula. *Boston M. & S. J.*, 194: 569, 1926.
6. Colby, F. H. Cancer of the colon involving the bladder. *Tr. Am. Soc. Genitourinary Surg.*, 28: 199, 1935.
7. Higgins, C. C. Vesico-intestinal fistula. *J. Urol.*, 36: 694, 1936.

TREATMENT OF GRANULOMATOUS PROCTITIS OF LYMPHOPATHIA VENEREUM

M. Heine Shear, M.D.

YORK, PENNSYLVANIA

BENIGN stricture of the rectum associated with lymphogranuloma inguinale has been investigated and established in etiology, pathogenesis, and diagnosis. Therapeusis, while on a nonspecific basis, has been favorably reported in the literature. All measures instituted, are individualized. Direct methods are effected towards alleviation of symptoms and prevention of complications.

Benign stricture is relatively common. All the therapeutic measures attack the pathologic entity of the chronic ulcerating stenosing proctitis, (stricture) and periproctitis in the terminal stages of the lymphogranuloma inguinale, but there remains the granulomatous proctitis, the treatment of which is inadequately discussed in the cases reported. This granulomatous proctitis persists after the procedures employed to rectify the benign stricture.

Several of the methods popularly utilized consist of either enlargement of the lumen of the stricture by plastic operations or dilatation. Temporary colostomy, a radical type of treatment, is still in use by some.

Granulomatous proctitis is usually found above and below the stricture. It may extend as far down as the linea dentata. To the palpating finger, the mucosa is thickened like a band, or indurated and corrugated. There is a marked delineation between the involved and the non-involved lumen. On proctoscopic examination the membrane is edematous and covered with whitish viscid purulent or sanguinopurulent secretions. When these are wiped away, the mucosa is pale and granular, with a tendency to bleed. The glands and the interglandular connective tissue are thickened. Ulcerated lesions are localized in area, but may show a marked depth in penetration.

The presence of proctitis is almost constantly associated with a seropurulent or mucopurulent discharge from the rectum.

Before discussing the treatment of granulomatous proctitis, it should be reiterated that the benign inflammatory stenosis, annular or tubular, should be attacked by the local methods mentioned previously. The decision obviously will rest on the surgical judgment of the physician and the extent of the pathology. Where surgical treatment is decided on, incisions which are carried to the verge are conducive to better drainage and aid in accelerating a good end result in the subsequent treatment of the granulomatous proctitis. For those cases which require dilatation, it may be well to remember that the proper sized proctoscope is an invaluable dilator, as the field is envisioned before the insertion of the obturator of the instrument. Irrespective of the method of attack, general anesthesia is contraindicated.

Immediately after the stenosis has been relaxed, incised or excised, the following formula is applied topically to the granulomatous proctitis, above and below:

Tincture iodine	30 c.c.
Menthol	0.65 Gm.
Tincture benzoin comp	50 c.c.
Glycerine	20 c.c.

These applications are made daily until the third day when deep heat is introduced in conjunction with them, and continued for ten days. Then the deep heat is continued alone, but the interval is lengthened to three times weekly for two weeks, and twice a week for one month.

Diathermy was found to be the only satisfactory method for producing deep heat. Picard[1] explains that diathermy,

because it generates sufficient heat, causes a revitalization of granulomatous tissue. The active electrode is a Hegar bougie just sufficient to pass the site of the treated stricture without pain. The method is simple and safe if the amperage is not excessive. Excessive amperage may provoke some hemorrhage early in the treatment of the congested membrane, but this is easily controlled. A current of one ampere for an exposure of ten to fifteen minutes will suffice to keep the intensity of heat in the granulomatous area averaging 40°C. grade. Length of individual treatments can be varied according to the severity of the condition.

The functional results and the local response were satisfactory. Treatment does not interfere with the adjuvant procedures of daily irrigations of medicated or non-medicated solutions to be used by the patient to keep the bowels clean. The technique is presented in the hope that more extensive trials will be made and its value determined.

REFERENCE

1. Picard, Hugo. Diathermiebehandlung der Strictures Recti. *Zentralbl. f. Chir.*, 52: 1709 (Aug.) 1925.

Experience . . . has shown that the best results are obtained if blood is withdrawn, stored and distributed from special centres equipped for the purpose. It is easier to ensure adequate sterility of apparatus and methods of collection when trained personnel work in suitably equipped institutes.

From—"War Wounds and Air Raid Casualties" (Lewis).

SURGICAL MANAGEMENT OF DUODENAL ULCER*

STANLEY EISS, M.D., F.A.C.S.

Adjunct Professor of Surgery, New York Polyclinic Medical School and Hospital

NEW YORK CITY

IN considering the surgical treatment of duodenal ulcer, it is first necessary to determine the indications for operation since the ulcer of itself is not necessarily a surgical condition. Medical treatment alone may suffice to control it.

The chief indication for the surgical treatment of duodenal ulcer is perforation; the second, obstruction. Substitution of surgery for medical treatment may also be indicated for certain complications, chief of which is hemorrhage, especially when recurring under good medical management; persistence of the symptoms and failure of the ulcer to heal, as demonstrated roentgenologically after medical treatment; or roentgenologic evidence of marked induration of the ulcer (such ulcers rarely heal even with the best medical management). Blahd[1] has found that if an ulcer shows a crater formation, and a small amount of barium is retained in the depths of the crater, it is intractable to medical treatment and operation should be performed.

When surgical treatment is clearly indicated, the question arises as to the type of operation which is most appropriate and expedient. While in continental Europe subtotal gastrectomy has been the operation of choice for many years, in England and America most surgeons employ gastroenterostomy in the majority of cases.

In 1935, Fogelson[2] presented a review of the literature (covering the year 1933) on surgical treatment of gastroduodenal ulcerative disease, and called attention to the excellent results obtained with gastrectomy by European surgeons, especially Finsterer and von Haberer, but he did not mention any American surgeon as an advocate of this operation. In 1934, however, Richter[3] found "a widening circle of accepted indications for gastric resection of peptic ulcer" in American literature. In 1937, when Fogelson[4] again reviewed the literature (for 1934 and 1936), he found a growing sentiment in favor of gastrectomy in England and America. He mentioned Ogilvie in England, Graham in Canada and Hinton and Lahey in the United States as advocating gastric resection in most cases of gastric and duodenal ulcers. In the last two years, reports by American surgeons on the favorable results of gastrectomy in peptic ulcer have become more frequent.[5–9] Cutler and Zollinger[10] are also now of the opinion that subtotal gastrectomy is the optimum procedure in many cases of peptic ulcer.

The employment of partial gastrectomy has been based largely upon personal observations of unfavorable sequelae resulting from gastroenterostomy. Gastric resection so frequently gives permanent relief that it is here advocated as the operation of choice. Where the condition of the patient is such as to preclude his withstanding a lengthy and highly technical operative procedure, gastroenterostomy is resorted to as an emergency measure.

Gastroenterostomy may be indicated in certain specific instances, such as cases with relatively low gastric acidity and with marked stenosis of the pylorus, especially when due to scar tissue and adhesions. Such findings are more often observed in elderly patients. Here gastroenterostomy is preferable to subtotal gastrectomy because it entails less risk and is a less radical procedure.

Where the ulcer is on the anterior wall of the duodenum, the ulcer-bearing area

* From the Department of Surgery, New York Polyclinic Medical School and Hospital.

is resected and a subtotal gastrectomy performed. If the ulcer is on the posterior wall of the duodenum, the ulcer-bearing area is similarly resected, if possible, and a subtotal gastrectomy performed. Should the ulcer be bound down and adherent to the underlying pancreas, careful dissection of the ulcer from the pancreas, close to the duodenal wall, is carried out, the rent closed, subtotal gastrectomy performed and drainage instituted. If the penetrating ulcer extends outward toward the papilla or if the callus infiltration of the ulcer is so extensive that the common bile duct cannot be isolated, the Finsterer resection operation for exclusion[11] is resorted to. If the first part of the duodenum is free, the pylorus is removed to insure adequate and safe closure of the duodenum.

Since operation for duodenal ulcer is not an emergency procedure except in perforation, the patient can be prepared by rest, administration of fluids, gastric lavage (if there is food retention) and repeated small blood transfusions where there is anemia.

Spinal, local, block, and splanchnic anesthesia has been used, but inhalation anesthesia of nitrous oxide, oxygen and ether has been found preferable and satisfactory in this series.

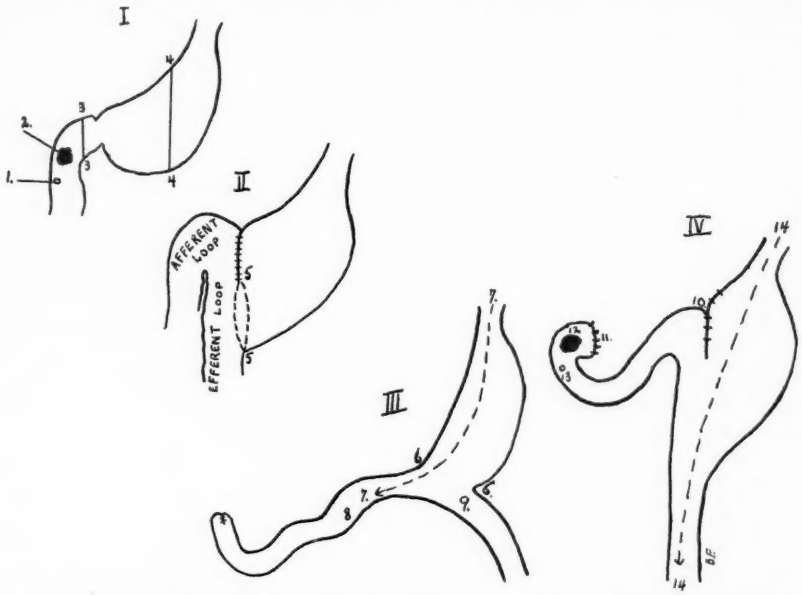


FIG. 1. I. 1, papilla. 2, ulcer. 3, line of resection at pylorus. 4, line of resection of stomach. II, 5, anastomosis—partial breadth of stomach; upper portion closed and attached to jejunum. III, patient with Polya-Reichel resection, in upright posture. 6, anastomosis of entire breadth of stomach without angle sutures. 7, direction of food current. 8, afferent loop of jejunum (giving rise to retrograde filling) lower than efferent loop, 9. IV, patient with Finsterer resection, in upright posture. 10, obliteration of three angled corner, fixing afferent loop of jejunum at higher level than efferent, preventing retrograde filling. 11, pylorus closed with Lembert sutures. 12, ulcer. 13, papilla. 14, direction of food current into proper efferent channels.

TECHNIQUE

A midline incision is made, long enough to give sufficient exposure for the entire operative field. The stomach and duodenum are examined to determine the exact location of the ulcer. If necessary, the exact localization of an ulcer of the posterior wall can be determined by a small gastrotomy opening in the antrum into which the palpating finger is inserted and through which the duodenal wall is explored. The Cameron light may facilitate visualization of a duodenal ulcer where palpation may fail to locate it.

By slightly elevating the liver the gastrohepatic omentum is made taut. Through a

rent in the avascular area of the latter, the middle finger and forefinger of the left hand are inserted, exploring the entire area behind the stomach down to the greater curvature. The right and left gastroepiploic arteries are ligated close to the stomach. Mass ligation is to be avoided in order to protect the blood supply of the omentum. The gastrocolic ligament is detached from the stomach, on the right as far as the duodenum, on the left about a handbreadth beyond the middle of the greater curvature. The blood vessels of the lesser curvature are ligated and two silk ligatures are applied to the blood vessels at the re-entrant angle. The lesser omentum, including the hepatoduodenal ligament, is divided.

A slit is made in the transverse mesocolon close to the left of the middle colic artery. The edges of the slit are secured by means of two guide sutures. About 10 cm. distal from the ligament of Treitz the proximal end of the jejunum is marked by a silk suture. A von Haberer stomach clamp is applied to the stomach at the point where resection is desired and at right angles to the body axis of the stomach itself. A Payr clamp is applied parallel to and about two fingerbreadths distal to the stomach clamp. A moist pad is placed behind that area of the stomach which is to be resected and the stomach cut across close to the Payr clamp. This may be accomplished by the knife or cautery. The distal portion of the resected stomach is covered with a moist pad and reflected for the time being away from the operative field.

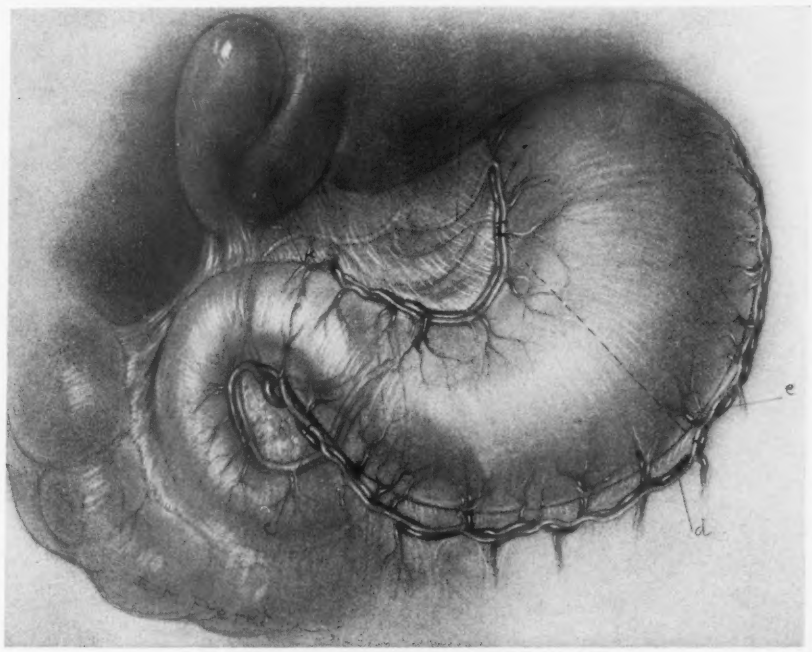


Fig. 2. Blood supply of stomach. *a*, gastric artery. *b*, pyloric artery. *c*, right gastroepiploic artery. *d*, left gastroepiploic artery. *e*, dotted line shows area of gastric resection. Points of ligation marked on vessels.

The left flap of the split transverse mesocolon is sutured to the posterior wall of the stomach in the operative field. The marked end of the jejunum is now brought through the split in the transverse mesocolon and two traction sutures are applied on the jejunum including the stomach at points directly opposite the remains of the lesser and greater curvatures. The first suture opposite the lesser curvature is inserted at the marked end of the jejunum by means of a fine silk serosal suture. The entire posterior wall of the stoma is attached in this fashion to the longitudinal axis of the jejunum between the traction

sutures. Where the stoma of the stomach is larger than desired a through-and-through suture of o chromic catgut is carried from the lesser toward the greater curvature until the stoma is no greater than four fingerbreadths. This is reinforced by a Lembert suture of linen or silk. An opening in the jejunum is made directly opposite and the same length as the stoma of the stomach. A through-and-through lock chromic catgut o suture is used in closing the anastomosis of the jejunum to the stomach. This is reinforced by the original serosal suture of silk or linen. The line of anastomosis is now covered by the right split half of the transverse mesocolon by interrupted sutures.

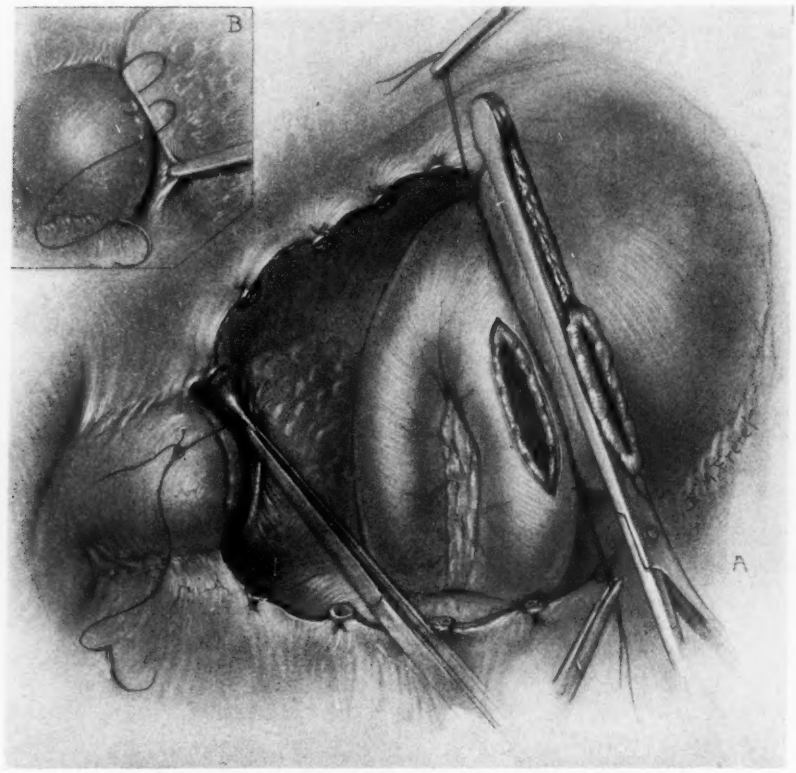


FIG. 3. A, von Haberer stomach clamp applied to stomach. Traction sutures applied on jejunum including stomach at points directly opposite remains of lesser and greater curvatures. Through-and-through chromic catgut No. o suture in stomach from lesser towards greater curvature, closed; stomach now no greater than four fingerbreadths. Opening of jejunum directly opposite and same length as stoma of stomach. B, duodenum closed by two Connell inversion sutures. Lesser omentum and capsule of pancreas sutured over the line of closure on duodenum.

The procedure just described precludes the necessity of inserting the safety sutures of Finsterer at the lesser curvature for the prevention of retrograde filling. This could not occur by the method presented.

In cases where the stomach is contracted, partial closure is at times inadvisable. In such instances the opening in the jejunum is made to equal the length of the opening in the stomach. In this case two or three angle sutures of fine silk or linen are inserted at the lesser curvature of the stomach to attach the jejunum to the stomach in such manner as to prevent angulation of the jejunum with ensuing closure of the anastomosis or retrograde filling.

The postoperative occurrence of retrograde filling merits serious attention in the consideration of the operative procedure to be followed. In the event that retrograde filling does occur as the result of food traversing the afferent loop instead of the

efferent loop of the anastomosis, the backward pressure in the resected stump may eventually give way, with an ensuing anastomosis, left to the last, has been done in haste. When *resection* is left to the last, and the condition of the patient precludes

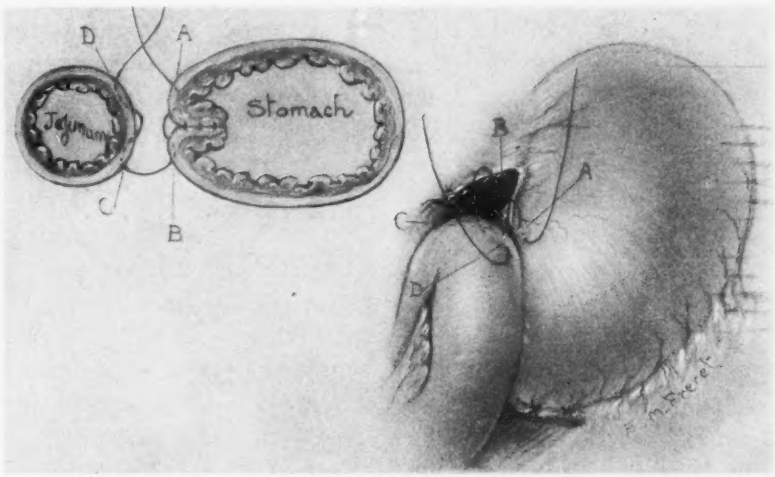


Fig. 4. Polya-Reichel resection. Entire breadth of stomach opening anastomosed to jejunum. A, B, C, D, angle suture of Finsterer for the prevention of retrograde filling. (Anterior wall of stomach, posterior wall of stomach, posterior wall of jejunum, anterior wall of jejunum. Three such sutures inserted.)

fatality. In nonresectable ulcers the misdirected chyme, constantly bathing the ulcerated area, prevents its ultimate healing and causes persistence of the original symptoms. The remaining right leaf of the split transverse mesocolon is sutured by means of interrupted linen or silk sutures, covering the line of anastomosis.

Frequently a Levine tube is utilized in the course of this operation. The tube is inserted a day or two before the operation for repeated lavage. When the stomach is resected the tube is pulled up a few inches from the operative field; after the anastomosis is completed the tube is pushed down into the jejunum for 6 inches and left in situ for about four days. This facilitates the administration of fluids, if necessary, and withdrawal of excessive secretions should they be present.

Instead of resecting the distal portion of the stomach first and then completing the anastomosis as the final stage in the operation, the procedure is reversed. In the method above described one is immediately able to visualize the pancreas and the structures behind the stomach. At times the condition of the patient is such that the proper termination of the operation, the distal end can be rapidly closed. Resection and removal of this end of the stomach may be completed at some other time when the patient's condition allows.

The reflected end of the distal portion of the stomach and ulcer-bearing area permits the proper visualization and palpation of the pathologic tissues. If it is decided that the duodenal ulcer can be removed, the duodenal ligaments are separated for about 2 cm. beyond the ulcer-bearing area and all bleeding points ligated, with care not to injure the bile ducts. At this point the duodenum must be separated from its underlying attachment to the pancreas. The gastroduodenal artery, if encountered, must be ligated. The pancreas is dissected away from the duodenum to the point of the ulcerated area. Two traction sutures are applied to the upper and lower borders of the duodenum beyond the ulcerated area and a clamp is applied distal to the ulcer. A small opening is made beyond that into the anterior duodenal wall, through which suction is used for the removal of duodenal contents. This opening is then enlarged and the duodenum is cut across,

freeing it from the ulcer-bearing area. The severed duodenum is closed by inverting it with two rows of fine silk suture, using the Connell stitch. A third row is used to bring the lesser omentum and capsule of the pancreas over the anterior portion of the duodenum.

Where the ulcer on the posterior wall of the duodenum is bound and adherent to the underlying pancreas, dissection is carried out as close to the duodenal wall as possible in order to avoid injuring the pancreatic ducts. The ulcer-bearing area is thus left behind, attached to the pancreas, and is cleansed with alcohol. The rent in the duodenal wall is closed and a soft rubber dam drain is inserted over the ulcerated area left behind. The operative procedure is carried out as described above. The duodenal stump is buried as interrupted sutures of fine silk or linen are taken into the edges of both hepatoduodenal and hepatocolic ligaments.

On the other hand, when the ulcer is so situated that it cannot be resected, either because of its location, its extensiveness or its adherence to the important underlying structures—pancreas, liver and gall-bladder—the resection operation by exclusion must then be utilized. The gastrocolic ligament is detached about two fingerbreadths proximal to the pylorus, and the same is done with the lesser omentum. Between two clamps the antrum is severed from the pylorus, unless the ulcer is located in the descending portion of the duodenum near the papilla. In this instance the pylorus is removed in addition to the antrum, the duodenum being severed close to the pylorus. The distal portion is closed with a through-and-through suture reinforced by a Lembert of silk or linen. The stump is then covered with gastrocolic ligament and a portion of the lesser omentum. Gastrojejunostomy is completed according to the method previously described, closing the abdomen with drainage. In the resection operation "by exclusion" the gastrojejunostomy may be left to the last because no time and effort are lost in the separation of the ulcerated, bound down and adherent duodenum to the underlying structures. There is no necessity for haste and for reversing the process, as described above in the operation of subtotal gastrectomy above.

COMMENT

It is at once apparent that the point of contention is the relative desirability of gastroenterostomy or subtotal gastrectomy. Many surgeons consider the latter procedure too radical for a condition that may be alleviated by simple gastroenterostomy. However, experience has shown that in capable hands subtotal gastrectomy need present a mortality no higher than gastroenterostomy. Ogilvie[12] states that a patient with a gastroenterostomy may be happy, but he is never safe. Ulceration at or near the stoma follows in at least 20 per cent of the cases. Such a complication may require one of the most difficult technical operations in the realm of surgery, and is attended by a mortality as high as 19 per cent. Ogilvie assumes that 5 per cent is a fair average for gastroenterostomy mortality. However, if 18 per cent of the survivors develop marginal ulceration and ensuing operative procedures result in a mortality of 22 per cent, the total death rate following gastroenterostomy will eventually be not 5 per cent, but 9 per cent. Therefore, subtotal gastrectomy in the hands of a skilled surgeon would eventually reduce the mortality by 4 per cent.

Ginzburg and Mage,[13] in a review of eighty-six cases of failures following gastroenterostomy, stated that though an efficient stoma in the gastroenterostomy tends to bring about the healing of an active duodenal ulcer, it also seems to favor the development of a marginal ulcer. They observed that the changes produced in an active duodenal ulcer by gastroenterostomy produced not a cure, but rather a remission of signs and symptoms.

In favor of subtotal gastrectomy it may be said that a patient is better off with a part of the stomach functioning normally than

with the whole stomach functioning abnormally. Furthermore, the removal of that portion of the stomach which bears the greater percentage of acid-bearing glands eliminates to a decided extent one of the main provocative factors of ulcer formation. While anastomotic ulceration may also take place in subtotal gastrectomy, experience has shown that when this occurs it is usually due to the fact that not enough of the acid-bearing area has been removed.

Lahey[14] has written: "In my mind jejunal ulcer is too frequent, too difficult and too dangerous a postoperative sequela for gastroenterostomy to be employed as a routine method of treating duodenal ulcer." Walters,[15] however, favors the more conservative method of gastroenterostomy, claiming that results are equally good.

Fogelson,[4] in his extensive review of the literature of gastroduodenal ulcerative disease for the years 1934–1936 draws the conclusion that the surgeon himself should select that type of surgical intervention which in the light of his own previous experience has been most satisfactory to him.

Eggers[16] seems to be averse to subtotal resection in duodenal ulcer. He advocates resection when repeated, especially massive hemorrhages, have not be controlled or after failure of conservative operations or for intractable pain, and possibly for gastrojejunal or jejunal ulcer.

It may also be possible that many more cases of jejunal ulcer may follow a gastroenterostomy than is reported from the larger clinics. It is often difficult to make comparisons. Statistics from the various clinics are equally confusing. One must not lose sight of the fact that death rates often considered as the result of operation are not directly caused by such operations. These may merely be contributing factors, for the functional unity of heart, lungs, kidneys and other vital organs is not the same in all patients subjected to gastroenterostomy or subtotal gastrectomy. The age, occupation, physical habitus, preoperative preparations, postoperative care and innumerable extraneous factors play an important rôle in the morbidity and mortality rate in gastric surgery.

It is for these reasons that a vital factor in the determination for the type of operation desired is not only the recognized indication for surgery but also the previous experience of such surgery in the hands of the operator.

I am indebted to Drs. John J. McGrath and Robert E. Brennan, Professors of Surgery, New York Polyclinic Medical School and Hospital, for their helpful suggestions.

REFERENCES

1. Blahd, M. E. Surgical indications for peptic ulcer and its surgical management. *Surg., Gynec. & Obst.*, 62: 203, 1936.
2. Fogelson, S. J. Gastroduodenal ulcerative disease. *Surg., Gynec. & Obst.*, 60: 1, 1935.
3. Richter, H. M. Gastric resection for peptic ulcer. *Surg., Gynec. & Obst.*, 59: 337, 1934.
4. Fogelson, S. J. Gastroduodenal ulcerative disease. *Surg., Gynec. & Obst.*, 65: 1, 1937.
5. Graham, R. R. Technical surgical procedures for gastric and duodenal ulcer. *Surg., Gynec. & Obst.*, 66: 269, 1938.
6. Miller, G. Subtotal gastric resection for peptic ulcer. *Surg., Gynec. & Obst.*, 65: 489, 1937.
7. Lahey, F. H., and Marshall, S. R. The surgical treatment of peptic ulcer. *New England J. Med.*, 217: 933, 1937.
8. Marshall, S. F., and Kiefer, E. D. Partial gastrectomy for gastric or duodenal ulcer. *J. A. M. A.*, 109: 1341, 1937.
9. Walters, W. Should gastric resection be done for duodenal ulcer? *Surgery*, 2: 759, 1937.
10. Cutler, E. C., and Zollinger, R. Surgery of the stomach and duodenum; procedures for peptic ulcer and gastric ulcer. *Surg., Gynec. & Obst.*, 67: 318, 1938.
11. Finsterer, H. The surgical treatment of duodenal ulcer. *Surg., Gynec., & Obst.*, 52: 1099, 1931.
12. Ogilvie, H. W. The place of surgery in the treatment of peptic ulcer. *Lancet*, 228: 419, 1935.
13. Ginzburg, L., and Mage, S. Failures following gastroenterostomy for gastroduodenal ulcer. *Surg., Gynec. & Obst.*, 67: 6, 1938.
14. Lahey, F. H. Peptic ulcer-gastric, duodenal and jejunal. *S. Clin. North America*, 15: 1401, 1935.
15. Walters, W. Operative treatment of gastric and duodenal ulcers: physiological and pathological principles influencing the type of procedure. *J. Michigan State M. Soc.*, 35: 491, 1936.
16. Eggers, C. Gastro-enterostomy. *Ann. Surg.*, 108: 84, 1938.
17. Levin, A. L. *J. A. M. A.*, 76: 1007, 1921.

A NEW PHYSICAL SIGN USEFUL IN THE EARLY DIAGNOSIS OF PERFORATED DUODENAL ULCER

JOHN O. BOWER, M.D.

PHILADELPHIA, PENNSYLVANIA

DIMINISHED liver dullness occurs in a great majority of patients suffering with acute perforation of the duodenum as an important early sign. This diminution may begin a few minutes after perforation, the usual time for a complete obliteration varying from one to three or four hours. I have observed cases in which the decreasing area of liver dullness was graphically portrayed by horizontal lines drawn to contact the retracting edge every thirty minutes. Associated with this there is usually demonstrable free fluid in the peritoneal cavity.

The average time between onset of symptoms and admission to the hospital in cases of perforated duodenal ulcer is over twelve hours. In the majority of cases, therefore, liver dullness has been obliterated before hospitalization. The demonstration of this sign depends upon the interchange of position between the air and the free fluid in the peritoneal cavity.

Method of Examination for Sign. The patient is placed in the supine position and the liver area percussed. If only partially obliterated, the exact area of liver dullness is outlined with ink, but in the majority of cases, obliteration will be complete. The patient is then requested to turn on his abdomen. He may object because of the exaggeration of the intense pain by any attempt to change position, in which case he should be helped over and asked to remain so for two or three minutes. He should then be placed on his back; the area of liver dullness can then be definitely outlined. If this area is repeatedly percussed at short intervals, dullness will be gradually replaced by tympany. It usually takes from one to three minutes for air to replace the fluid which suggilates to the dependent part of the peritoneal cavity.

While the diagnosis of acute perforation of the duodenum can usually be made from the history, and the board-like rigidity that accompanies it, it is very difficult at times to differentiate it from acute pancreatitis and high intestinal obstruction. Likewise, when a duodenal perforation is subacute, it is difficult to differentiate it from early fulminating appendiceal perforation.

In both acute pancreatitis and high intestinal obstruction, free fluid may be demonstrated, but of course, air will be absent from the peritoneal cavity. In subacute perforation of the duodenum and in the fulminating appendiceal perforation, gas is usually not present in sufficient quantity to be of definite importance.

Aside from its diagnostic significance, the demonstration of this sign will lessen the financial burden to the hospital, as well as to the patient. The customary flat *x*-ray plates made of the abdomen to demonstrate the presence of air beneath the diaphragm in cases of questionable diagnosis will not be necessary.

APPENDICITIS INDUCED BY TRAUMA

JOHN T. BATE, M.D., F.A.C.S.

LOUISVILLE, KENTUCKY

OVER the last decade, discussions of appendicitis induced by trauma have been appearing in the surgical journals with more frequency. Nearly each discussion has spoken with the increasing weight of authority of the preceding articles cited. An editorial in the *Journal of the American Medical Association* concludes, "The pertinent question is not whether trauma can originate an initial attack of appendicitis, or whether its effect is that of lighting up dormant pathologic conditions. It is, rather, whether or not trauma can precipitate a clinical attack of acute appendicitis. The consensus is not only that it can, but that the resulting attack is likely to be one of a grave, destructive type, with a clear clinical picture. Usually, after a blow on the abdomen, a kick, a fall, or a sudden muscular strain, severe abdominal pain occurs followed by vomiting. The initial pain and vomiting are characteristic and are presumably due to intraperitoneal shock. Then, in most cases, as pointed out by Behan, both symptoms cease and return later, as the result of the progression of inflammatory changes within the abdomen."

After having read the five references appended to this editorial as well as many other references beginning with Kelly's exhaustive monograph published in 1905, this writer believes it would be well to pause and reconsider the cases which have been reported in the literature before endorsing the view taken in this editorial.

Boyd, in discussing the etiology of appendicitis, brings out well known facts which most of the articles ignore: "It is a curious fact that although appendicitis is such a very common disease the etiological factors still remain vague and indefinite. The frequency of the disease is only of recent date. Appendicitis was present but was relatively rare, in highly civilized communities until the end of the nineteenth century. Since that time it has become very common in these countries. The rise began in England about 1895, and was pronounced between 1895 and 1905; since then it has been fairly stationary. It was in the cities and amongst the better off classes that the rise was most marked; inmates of institutions on a plain diet are relatively immune.

"The national distribution of the disease is very interesting. It is common in the highly civilized countries such as Great Britain, the United States, France and Germany. In Denmark and Sweden it is lower. In Spain, Greece, Italy, and the rural parts of Roumania it is very low. Lucas-Championnière found one case of appendicitis in 22,000 patients among Roumanian peasants, whilst in the cities of Roumania he found one case in every 22 patients. McCarrison states that during the nine years that he practiced among the hill tribes of Northwest India he never saw a case of appendicitis. In Asiatics, Africans, and Polynesians it is very rare, unless they take to European food; then it becomes common. In wild animals it is rare or unknown. In animals in captivity it is common, especially among the apes in zoological gardens.

"Rendle Short points out that the link connecting these various facts may be found in the absence of cellulose and fiber from modern civilized food. It was between 1890 and 1905 that the chief change occurred, owing partly to the greater importation of food stuffs."

The exciting cause is equally elusive. Indeed, although foreign bodies such as oxyuris or concretions are occasionally found, and adhesions and kinks may obstruct the appendix, in the majority of

cases it is impossible to say what has precipitated the attack.

The editorial previously mentioned concluded that the trauma might be direct, such as a blow to the abdomen, a kick or a fall on the abdomen, or the pinioning of the abdomen against a fixed object, or indirect resulting from prolonged muscular strain or untoward or unusual sudden muscular action. Overdistention of the organ by the influx of cecal contents as the result of trauma was regarded as the most plausible cause of traumatic appendicitis. However, in the light of what we know about the etiology of appendicitis, the theory is not very plausible. In many of the cases the patients were financially interested in establishing trauma as the cause of their disease. This makes it improbable that a true history of the development of the illness was given.

Among the inciting traumatic causes given in the literature most of the activities which make up our daily lives have been named: walking, dancing, running, stooping, lifting, falling. When we consider that the hill tribes of northern India stoop, run, ride beasts of burden, fall, fight, and probably even dance their own steps, without developing appendicitis, it seems improbable that these activities, which for many people make up existence itself, could be the cause of acute appendicitis as we know it, i.e., (1) acute catarrhal appendicitis where the infection commences at the mucosal lining and probably invades the walls to a variable extent, and where resolution may be complete, or where some residual scarring may be left; (2) acute diffuse appendicitis where the infection commences at the bottom of one of the crypts, and may extend throughout the organ and may result in acute gangrenous appendicitis.

In acute appendicular obstruction we have some slight pathologic evidence to support the case of trauma as a contributing cause. Wilkie has emphasized the importance of distinguishing between two varieties of acute appendicular disease, namely, acute appendicitis and acute appendicular obstruction. The end result may be the same, but the method of production, the mode of onset, and the early clinical symptoms are different. In primary acute inflammation the pathologic process commences essentially as an inflammation of the wall of appendix. In primary acute obstruction, on the other hand, the essential lesion is the obstruction; the inflammation follows as a secondary consequence.

The peculiarity about the onset in acute appendicular obstruction is that at first the symptoms are purely local, and it is not until later that the general signs of inflammation manifest themselves. The important features distinguishing primary obstruction from primary inflammation are: (1) the great severity of the pain; (2) the suddenness of its onset; and (3) the absence of disturbance of the pulse and temperature during the early stages of the illness. This absence of what are regarded as important indications of appendicular disease may be very misleading, but it must be realized that if acute inflammation of the appendix is a serious condition, acute obstruction is even more so and calls for equally immediate operation.

The predisposing causes of acute obstruction are: (1) fibrous stenosis of the appendix; and (2) acute kinking of the appendix by a band or a fold. Fibrous stenosis is due to some previous attack of inflammation, which often passes quite unrecognized; the narrowing of the lumen at the proximal end may be so extreme that only a pinhole is left. A band or a fold which causes fixation of the appendix at some point is a common cause of obstruction. Such a band may be an old inflammatory adhesion but even more frequently it is a congenital fold which ties the middle of the appendix down toward the pelvis.

The exciting cause is a sudden access of fecal material to the partially obstructed appendix. This sudden access may be theoretically the result of straining or of some form of trauma, the latter being a

not infrequent precursor of an attack of acute appendicular obstruction. We may theorize that a slight reaction occurs in the distal part of the appendix, and the associated swelling rapidly intensifies the obstruction or accentuates the kink. In some cases a concretion is found beyond the obstruction, and the irregular peristalsis of the appendix may drive it into the narrowed part, thus rendering the obstruction complete.

Wilkie has shown in a very interesting way the effect of varying conditions on an isolated loop of ileum, the ends of which were closed. (1) When the loop was empty, it became distended with mucus until a mucocele developed. (2) When the loop was moderately full of fecal material, the animal having been fed on a carbohydrate diet, an empyema of the loop gradually developed. (3) When the loop was full but the animal had been fed on a rich protein diet, the changes were much more acute, and the animal was dead within twenty-four hours.

The analogy to the conditions found in the human appendix is obvious. When the empty appendix becomes completely obstructed the result is a hydrops or mucocele of the appendix. When the obstructed appendix contains some fecal material, probably not rich in protein, an empyema of the appendix gradually develops. Those common cases where distention and gangrene come on with startling rapidity correspond to the condition in the artificial appendix filled with feces after protein feeding.

Reference has already been made to the prevalence of acute appendicitis in civilized communities and in cities as compared with uncivilized communities and rural districts. Speaking generally it may be said that in the former proteins are consumed, in the latter carbohydrates. Post-mortem statistics suggest that fibrosis and scarring due to mild attacks of inflammation are common in all nations, but the urgent gangrenous type is confined to the meat-eating peoples. Acute appendicular disease is more than twice as common in the male as the female. This may, within the limits of possibility, be due to the fact that the young adult male is more subject to strain and trauma, and that his diet is usually richer in protein than that of the female. Finally, the acute form is rare in the first years of life and in old age. In the former obstruction cannot readily occur, whilst in the latter the lumen is often obliterated by fibrotic changes.

CONCLUSIONS

While it seems theoretically possible that trauma may occasionally be a factor in acute appendicular obstruction, it is probable that it is very infrequently so, because it is rare among these people living under the peasant conditions of Europe and the tribal conditions of India who eat meat plus an unrefined diet, and who are subject to trauma in all its forms.

I acknowledge indebtedness to Boyd's "Surgical Pathology" for much of the above material.

APPENDICEAL OXYURIASIS*

EARLE I. GREENE, M.D. AND J. MAJOR GREENE, M.D.

Assistant Professor of Surgery, Northwestern University Medical School

Instructor in Surgery, Northwestern University Medical School

CHICAGO, ILLINOIS

APPENDICEAL oxyuriasis is a disease found the world over, although its frequency varies considerably in different parts of the globe. In France, Brumpt[1] studied 800 cases and found the oxyuris in 3.4 to 5 per cent. Ralliet[2] found the worm in 14 per cent of thirty-three organs removed, and a second time, in fifty-eight of 119 appendices examined. From Germany, Suzuki[3] in 500 autopsies and 103 surgically removed specimens found thirty-eight cases in the first group and sixteen in the second series. Fisher[4] reported forty-six instances in a series of 110 surgically removed specimens, and in 105 post-mortem cases found the oxyuris in thirty-nine. Castellani[5] quotes Garrison's figures at 8 per cent for the Philippines; Dobson's[6] at 15.37 per cent for India. Wood[7] reports from Australia seven cases in fifty-seven extirpated organs. Gordon[8,9] in this country, in 26,051 specimens from the University of Michigan, found 311 cases. In England, Still[10] found the worm in thirty-eight of 200 consecutive autopsies on children under 12 years of age. A second report by this author presented thirty-two additional cases in 100 necropsies on children between 2 and 12 years. Eastwood[11] found twenty-eight instances in a series of 123, seventy-three of which were operative organs and fifty post-mortem specimens. On the other hand, Crile[12] failed to record a single instance in 1,000 surgically removed appendices. Deaver[13] found the worm once in 500 operated organs.

The disease was first mentioned by Still in 1899. Since then there has been considerable controversy as to whether the worm is the causative factor in the production of acute appendicitis. The opinion has been sharply divided into three schools: those who believe that there is a definite relationship between the worm and inflammation of the organ (Metchnikoff,[14] Rheindorf,[15,16,17] Cecil and Buckley,[18] Riff,[29] Harris and Brown,[20] Innes and Campbell,[21] Suzuki[3]); those who doubt the ability of the worm to produce an inflammatory reaction (Aschoff,[22,23,24] Hueck,[25] Brauch,[26] Fisher,[4] Drigalski and Koch,[27] Eastwood,[11] Steichele,[28] Wood[7]); a third group is of the opinion that the parasite is capable of producing minute lesions in the mucosa of the appendix, thereby permitting fecal matter to enter, resulting in inflammation (Jaroschka,[29] Ssolowjew [30]).

Of late, however, the opinion among most pathologists is that the worm is not the causative factor in the production of an acute inflammation. In Gordon's series, the largest on record, not a single case was found in which the oxyuris could be said to play a rôle. In this series, Gordon studied eight acute appendices, four acute purulent and two acute gangrenous organs. The worms were present, but never was there any evidence of involvement of the mucosa. At no time did he find a more severe or advanced degree of inflammation at the level containing the oxyuris than occurred in areas free of the worm.

It has been a common experience to find, in the amputated appendix harboring the worm, that the parasite has penetrated the wall. There is much to prove that the act of penetration took place after the organ had been removed, for there is no evidence of tissue reaction surrounding the worm. Many of these appendices showed hyperplasia of the lymphoid tissue, fecal concretions, dilatation of the lumen, atrophy and

* From the Department of Surgery, Northwestern University Medical School.

chronic catarrh of the mucosa, or combinations of these changes. According to Warthin,[31] such findings are classified as "no active process."

The disease occurs most commonly in children between 2 and 16. A case in a 69 year old male is found in Gordon's report. Female children are the victims three times more often than males.

The eight cases we are reporting offer a good cross section of the literature on oxyuris appendicitis. In this group there were six females and two males. The oldest was 17, the youngest 6.

Duration of Symptoms. Six were sick twenty-four hours before entering the hospital. One was ill for two and one-half days before surgery was instituted. The eighth child was operated upon after an illness of three days.

Previous Attacks. One-half of this series gave a history of previous attacks of abdominal pain. Two complained of repeated attacks for two years; two had had attacks for over a year, whereas the fifth offered a question as to previous manifestations.

Temperature. All the patients entered the hospital with some rise in temperature. The highest was 102 degrees, the lowest 99.8 degrees. On admission five of the children had a temperature of 100 degrees. One entered with a reading of 105, but a concomitant chest condition accounted for the acute rise.

Nausea and Vomiting. Seven complained of nausea. Vomiting from one to three times occurred in six patients.

Abdominal Pain. All complained of some type of abdominal pain. Six stated that the onset was with diffuse or periumbilical pain, later localizing to the right lower quadrant. In two the onset was with pain in the right lower quadrant.

All complained of tenderness in the right lower quadrant.

Rigidity. This phenomenom presented itself in 50 per cent of the cases, being especially found over McBurney's area. One child showed doubtful spasm, whereas in two others no mention is made of the finding.

Rebound tenderness was present in only one instance.

Distention was noted once.

White Blood Count and Differential. The highest count was 13,900, the lowest 5,800. One child was admitted with a 31,200 count, but a complicating pneumonia was the responsible factor. Six had a marked increase in polymorphonuclear leucocytes, the highest being 86 per cent. It is interesting to note that in the only instance in which the pathologist made a diagnosis of acute ulcerative appendicitis, the white count was 8,800, with 49 per cent polymorphonuclear leucocytes.

Bowels. Diarrhea was a symptom in one case. One was constipated, whereas the others gave no story of change in bowel habits.

Preoperative Diagnosis. A preoperative diagnosis of acute appendicitis was made seven times. In the eighth case there was a history of repeated attacks of acute abdominal pain for two years. On several occasions a diagnosis of acute appendicitis had been made. Operation was advised because of these recurrent attacks.

Operative Findings. Free fluid in the abdominal cavity was found five times. Two appendices had bulbous tips. Two contained fecoliths. An edematous organ was reported twice.

Three organs were diagnosed as acute appendicitis by the operating surgeon. One was called an obstructive appendicitis, another, a chronic interval appendix; the others were considered as subacute specimens.

Pathologic Report. Only one of the cases was reported as having any evidence of acute inflammation. All others were reported as containing the oxyuris.

Stool Examination. After the worms were discovered, the stools of four patients were examined. The worm was isolated once; eggs were found in one instance, whereas in the other two the stools were negative.

There was one death in this series. The patient was a 6 year old male who entered the hospital after a three day illness. On admission his temperature was 105 degrees, the white count was 31,200, of which 88 per cent were polymorphonuclear leucocytes. Peri-umbilical pain at the onset was followed shortly by a chill. At the hospital the child was extremely toxic, very dyspneic, coughed considerably and had a marked expiratory grunt. Examination of the chest showed evidence of a bilateral pneumonia. The entire abdomen was markedly rigid, with exquisite pain and tenderness in the right lower quadrant. The pediatrician felt that in addition to the pneumonia the child had an acute appendicitis, and urged removal of the appendix. This was done under local anesthesia, and a slightly injected appendix was removed. Subsequently the boy developed an empyema, with blood cultures positive for type 4 pneumococcus. Death occurred on the seventh postoperative day. Autopsy showed a pneumothorax and collapse atelectasis of the left lung; empyema and post-pneumonic atelectasis of the right lobe; bronchopneumonia; oxyuris in the appendix. No active process was demonstrated in the amputated organ.

In reviewing the literature as well as from these cases, one is impressed with the fact that almost invariably the preoperative diagnosis is acute appendicitis. The abdominal pain, the frequency of nausea and vomiting, the slightly elevated temperature, the tenderness and frequent rigidity in the right lower quadrant, the increased white cell count, the increase in the polymorphonuclear leucocytes, all make for this diagnosis. Many of the symptoms and findings are most difficult to explain. Aschoff believed that the activity of the worm, acting as a foreign body might cause painful contractions of the muscular wall and produce pain. Can this explain the rigidity? If, as believed by many pathologists, the worm cannot produce an active inflammation, how then can we explain the rise in temperature, the increase in white count, the polymorphonuclear leucocyte increase? Some investigators have expressed the thought that the oxyuris produces a toxin. This may, perhaps, explain some of the symptoms. It is obvious, nevertheless, that no symptom or absence of symptoms of appendiceal oxyuriasis can distinguish the disease from a true appendicitis.

SUMMARY

1. Eight cases of appendiceal oxyuriasis are presented.

2. Seven were diagnosed as acute appendicitis.

3. No symptom or lack of symptoms will differentiate the disease from a true acute appendicitis.

5. Removal of the appendix cures the patient.

REFERENCES

1. Brumpt, E. Précis de parasitologie. Paris, 1913. Masson.
2. Ralliet, G. Sur les parasites de l'appendice malade. *Comp. rend. Soc. de biol.*, 70: 310, 1911.
3. Suzuki, K. The rôle of oxyuris vermicularis in the etiology of appendicitis and allied conditions. *Surg., Gynec., & Obst.*, 21: 702–721, 1915.
4. Fisher, W. Oxyuten und appendicitis. *Deutsche Ztschr. f. Chir.*, 183: 222–245, 1925.
5. Castellani, A., and Chambers, A. J. Manual of Tropical Hygiene. New York, 1919. Wm. Wood.
6. Dobson, A. Cited by Castellani.[5]
7. Wood, W. A. Appendicopathia oxyurica. *M. J. Australia*, 1: 234–235, 1918.
8. Gordon, H. Appendiceal oxyuriasis and appendicitis. *Arch. Path.*, 16: 177–194, 1933.
9. Gordon, H. Appendiceal oxyuriasis. *Ann. Int. Med.*, 4: 1521–1534, 1931.
10. Still, G. F. Observations on oxyuris vermicularis in children. *Brit. M. J.*, 1: 898–900, 1899.
11. Eastwood, E. H. The relation between appendicitis, oxyuris vermicularis and local eosinophilia in the appendix wall. *J. Path. & Bact.*, 26: 69–81, 1923.
12. Crile, G. W. A summary of 1000 cases of appendicitis with observations on the etiology. *Ohio State M. J.*, 2: 615–617, 1906–1907.
13. Deaver, H. C. Appendicitis in childhood, with a report of 500 cases. *J. A. M. A.*, 55: 2198–2205, 1910.
14. Metchnikoff, L. Rôle des helminthes dans l'appendicite. Jour. d. Praticiens, Paris, 15: 185, 187, 1901.
15. Rheindorf, A. Ueber die durch die Oxyuris Vermicularis hervorgerufenen pathologisch-anatomischen Veranderungen in her Wand des

Wurmfortsatzes nebst Betrachtungen ueber die Genese und das Vorkommen der Appendicitis. *Frankfurt. Ztschr. f. Path.*, 14: 212–266, 1913.

16. Rheindorf, A. Hysteroneurasthenie oder chronische Appendicitis? Zugleich ein Beitrag zur Appendicitisfrage und der ihrer Bezielung zur Oxyuris. *Berlin klin. Wchnschr.*, 51: 1211, 1271, 1914.
17. Rheindorf, A. Beitrag zur Frage der Bedeutung der Oxyuren bei der Wurmfortsatzenzundung der Kinder. *Berlin klin. Wchnschr.*, 49: 451–503, 1912.
18. Cecil, R. L., and Buckley, K. On the lesions produced in the appendix by oxyuris vermicularis and trichocephalus trichiura. *J. Exper. Med.*, 15: 225–245, 1912.
19. Riff, A. Contribution à l'étiologie de l'appendicite. *Presse méd.*, 27: 521–524, 1919.
20. Harris, W. H., and Browne, D. C. Oxyuris vermicularis as a causative factor in appendicitis. *J. A. M. A.*, 84: 650–654, 1925.
21. Innes, J. A., and Campbell, A. E. The occurrence of oxyuris vermicularis in the human vermiform appendix. *Parasitology*, 7: 189–200, 1914–1915.
22. Aschoff, A. Appendicopathia oxyurica (Pseudoappendicitis ex oxyure). *Med. klin.*, 9: 249–251, 1913.
23. Aschoff, A. Sind die Würmer, besonders die Oxyuren, direkt oder indirekt schuld an der Appendicitis? *Berlin klin. Wchnschr.*, 51: 1504–1507, 1914.
24. Aschoff, A. Mussen wir unsere Anschauungen über die Aetiologie der Wurmfortsätzentzundung ändern? *Berlin klin. Wchnschr.*, 57: 1041–1046, 1920.
25. Hueck, O. Ueber die pathologische Bedeutung von Helminthen in der appendix. *Frankfurt. Ztschr. f. Path.*, 13: 434–474, 1913.
26. Brauch, M. Ueber Appendicopathia oxyurica. *Beitr. z. Path. Anat. u. z. allg. Path.*, 71: 207, 262, 1922.
27. Drigalski, W., and Kock, E. W. Ueber die Bedeutung des Wurmfortsätzes für die Entwicklung der Oxyuren. *Deutsche med. Wchnschr.*, 51: 309–311, 1925.
28. Steichele, H. Appendicitis und Oxyuren. *Arch. f. klin. Chir.*, 135: 373–381, 1925.
29. Jaroschka, K. Ueber Typhlitis und Appendicitis verursacht durch Oxyuren. *Deutsche Ztschr. f. Chir.*, 183: 99–113, 1923.
30. Ssolowjew, N. J. Beiträge zur Frage ueber die Rolle der Oxyuren in der Aetiologie der Appendicitis. *Mitt. a.d. Grenzgeb. d. Med. u Chir.*, 41: 20–31, 1928.
31. Warthin. Cited by Gordon.[8]

TREATMENT OF VARICOSE VEINS*

H. D. COGSWELL, M.D. AND CLAYTON SHIRLEY, M.D., F.A.C.S.

TUCSON, ARIZONA TYLER, TEXAS

THE injection treatment of varicose veins has enjoyed a wave of popularity in the past few years and as a result surgical procedures have fallen into discard. This is largely due to the fact that the sclerosing solutions have become more efficient, the injection treatment seemed to be less formidable than surgery, and hospitalization could be avoided. The test of time has shown that permanent results were not being obtained and more radical measures than the injection of sclerosing solutions are required for permanent relief. The treatment of varicose veins by ligation and injection is known to have been performed over thirty years ago. This form of therapy, however, was not emphasized until recently and is now recognized as the most reliable method of obtaining permanent cures.[1,2,3,4] There are some cases which respond to injection treatment alone, but these are in the minority. Varicosities generally are still being under-treated. Modern treatment should be more thorough treatment, with fewer recurrences.

To treat successfully varicose veins and their complications the extent of the underlying disease must be recognized. No form of therapy should be instituted until the efficiency of the valves of the saphenous and communicating veins and the patency of the deep circulation is known and arterial disease of the lower extremities ruled out. These factors are determined as follows:

A. *Tests to Determine the Valvular Competence of the Saphenous Veins and Its Communicating Branches with the Deep Circulation.* 1. Schwartz test:[5] The flat portions of the fingers of one hand are placed along the usual course of the saphenous vein in the thigh, and the vein is sharply tapped on one of its varicosities below the knee. If there is incompetency of the saphenous valves, a distinct impulse is transmitted to the palpating fingers through the tense column of blood. This test is also of value in tracing the course of the saphenous vein.

2. Trendelenburg test:[6] This test gives information regarding competence of the valves of the saphenous and communicating veins. The affected extremity is elevated so that it is emptied of its venous blood, then rapidly lowered. If the varicosities are observed to fill rapidly, it is evidence that the valves of the saphenous vein are incompetent. The leg is again elevated, a tourniquet is placed at the saphenous femoral junction, and the leg is lowered. (Fig. 2.) If the veins of the lower leg remain collapsed or fill slowly from below it is proof that the saphenous valves are incompetent. If the varices rapidly fill, the valves of both the communicating veins and the saphenous vein are inadequate; this is a "double positive" test. (Fig. 3.)

B. *Tests to Determine the Patency of the Deep Circulation.* 1 Perthes' test:[7] The saphenous vein is constricted in the lower portion of the thigh and the patient is instructed to stand and flex and extend the knee vigorously ten times. If the deep circulation is functioning normally, the blood is sucked from the varicosities (superficial circulation) into the deep veins by the muscular contractions. On releasing the constriction the varicosities refill from above, demonstrating the amount of blood taken by the deep venous system.

2. Compression test: It is difficult in some individuals to evaluate the Perthes' test. In these cases the compression test is of value and may be accomplished in two ways.

* From the Thomas-Davis Clinic.

(*a*) An ace bandage or an elastic stocking extending from the toes to the knee is worn by the patient for three to four days.

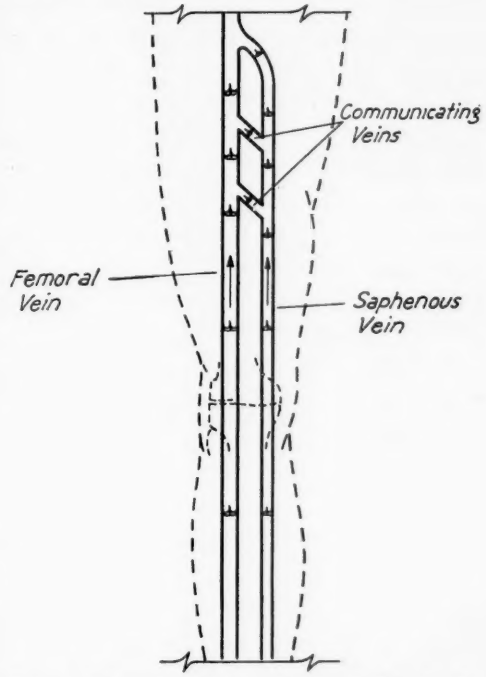


Fig. 1. Normal deep and superficial circulation with the communicating veins illustrated. Direction of blood flow indicated by arrows. Varicosities occurring with a normal valvular system such as the above should be treated by injection only. Communicating veins of lower leg not illustrated.

If his symptoms are relieved and the elastic support does not cause pain or cramping after being worn constantly, one may be assured that in all probability the deep circulation is adequate. This type of appliance compresses the superficial veins and the deep venous network must carry the venous blood.

(*b*) A rubber bandage is applied with enough compression to close the external veins. This should extend from the toes to above the knee with the patient lying down. The compression is maintained for forty-five to sixty minutes. If this is comfortably tolerated and there is no edema of the toes, one may be reasonably sure that the deep veins are capable of carrying on the circulation. This test should be carried out where the patient can be observed at frequent intervals and the bandage removed if pain or discomfort of the legs or edema of the toes occurs. A past history of "milk leg" or persistent edema

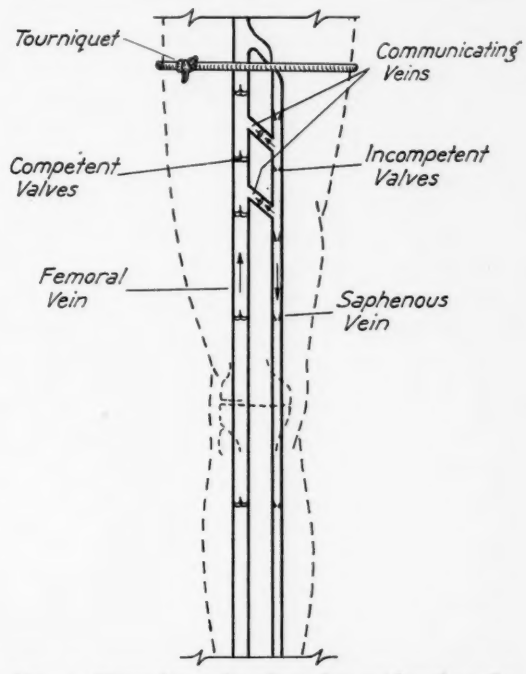


Fig. 2. Tourniquet in place for performing the Trendelenburg test. Arrows point direction of blood flow without tourniquet. Since the back flow of blood through the saphenous vein is prevented by occluding the saphenofemoral junction and communicating valves are competent, the varicosities of the lower leg slowly fill or remain collapsed when the leg is lowered. Ligation and injection of the saphenous vein are required for the cure.

of the affected extremity usually contraindicates active treatment. If there is any doubt as to the patency of the deep circulation after performing the above tests only palliative treatment is indicated.

C. *Determining the Presence of Arterial Disease.* Arterial diseases of the lower extremities should always be ruled out before treatment is undertaken. Senile or diabetic arteriosclerosis may be detected by absence of the pulsation of the posterior tibial and dorsalis pedis arteris. Thromboangiitis obliterans is discovered, by the Samuel test where the legs are elevated to right angles to the body with the patient in the reclining position. The feet are rapidly extended and flexed. If the plantar surfaces of the feet become blanched and

pain occurs in the calf of the leg, arterial disease of the lower leg may be assumed to be present.

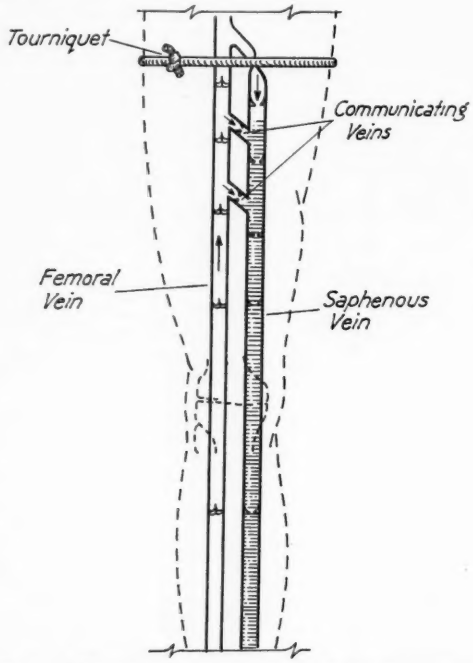


FIG. 3. Due to incompetency of the communicating as well as the saphenous valves, the varicosities rapidly fill as the tourniquet does not prevent the back flow of blood through the communicating veins. When this occurs it is a "double positive Trendelenburg test." Ligation and injection are required in these cases for permanent relief.

TREATMENT

1. Age, debility and prejudice against surgical procedures make it necessary to give only palliative treatment in some instances. In these cases the varices may be controlled by an elastic support of the lower extremities. These supports compress the external circulation relieving venous hydrostatic pressure. Ace bandages or elastic stockings serve this purpose well.

2. If the valves of the communicating and saphenous veins have been shown to be competent and the deep circulation patent, the varicosities may be injected at intervals, and ligation is not recommended. (Fig. 1.)

3. It has been recommended that patients with inadequate saphenous valvular systems but with normal valves of the communicating veins have ligations only at the saphenofemoral junction. We feel that the routine ligation of the saphenous vein just above the knee immediately before ligating and injecting at the saphenofemoral junction gives the most satisfactory results, whether the communicating valves are competent or not. (Figs. 2 and 3.) In the majority of our cases we have made a third ligation between these two points injecting the distal end of the vein in the middle and upper areas. In this way the chances of the vein recanalizing are more remote and there is a more even distribution of the sclerosing solution. Lowenberg[8] regularly ligates the saphenous vein at the knee and in the groin since he believes that it lessens the postoperative reaction.

4. Untreated varicosities lead to complications. Of these ulceration is the most outstanding and resistant to treatment. Prolonged passive congestion results in a malnutrition of the skin, lowering its resistance so that slight trauma or infection may result in a break in its continuity. Once broken, the skin is soon infected, and an ulcer results. The skin edges of these ulcers tend constantly to separate[9] resulting in a wider bed for infection and more tissue destruction. Staphylococcus, streptococcus, bacillus pyocyaneus, and fungi are usually found in this type of ulcer. Consequently, both germicides and fungicides are needed for its treatment.

The conservative treatment for ulcers is to place the patient in bed with the affected extremity elevated, and apply chlorazene, diachloramine T, or mercurial compounds to the ulcer constantly. An elastic support is placed over the lower leg extending from the toes to above the knee. Healing usually takes place in two to six weeks.

This treatment is not satisfactory, and ulcers commonly recur since the varicosities, their underlying cause, have not been cared for.

Most ulcers can be cured while the patient remains ambulatory, and for economic reasons it is obviously the desired form of treatment. If the ulcer is severely infected, hot packs, elevation of the extremity, and wearing of an elastic sup-

port should be the method of treatment until the infection is under control. When the inflammation has subsided ligation of the saphenous vein is performed in the same manner as in uncomplicated cases of varices with valvular incompetence. Later the varicosities proximal to the ulcer are sclerosed by injection. The ulcer is covered with an antiseptic dye or ointment as gentian violet or merthiolate ointment. Strips of adhesive tape are placed over the ulcer, a rubber sponge is applied evenly over the adhesive and is held in place by an elastic bandage which envelopes the lower leg. The dressing should be changed every three to seven days, and if necessary, further injections can be given at the time of the dressings.

Ulcers which have persisted over a long period of time occasionally will not heal because of fibrosis and scar formation. The treatment of these ulcers must be radical, and they are cured by diminishing the infection, excising the ulcer with its scar tissue, and applying split skin grafts over the resulting raw surface.[10]

The most common complication of varicose veins is thrombophlebitis, which occurs in about one-half of all the patients with this condition.[11] Phlebitis of the saphenous vein produces palpable and visible red streaks along the vein, is usually painful, causes but little systemic reaction, and is seldom a fatal condition. The treatment of phlebitis of varicose veins varies greatly from the treatment of phlebitis of the deep circulation. Thrombophlebitis of the saphenous veins is treated actively[12] to prevent further extension of the thrombosis and possible embolism. Ligation and section of the saphenous vein at the saphenofemoral junction, followed later by the injection of the varicosities, is the treatment of choice. Since thrombosed veins will recanalize with loss of the venous valves,[13] the ligation serves two purposes: it cures the thrombophlebitis and prevents the reformation of varicose veins. Edwards[11] states that this "treatment is based on the attitude that the phlebitis is but a complication, and the treatment is immediately directed against the varices." Most individuals can remain ambulatory after ligation with the support of an elastic bandage. If for any reason the patient is confined to bed, he should carry out routine exercises of the legs and move frequently. While the leg is at rest it should be elevated to promote venous circulation.

Rupture of a varix is not a major complication. Thin walled, saculated veins rupture near the skin surface, and pressure over the site of the rupture with elevation of the leg promotes healing.

5. Few patients require second operation. Due to incompetent perforating veins in the lower leg or inadequate valves of the short saphenous vein a small number of varices do not remain closed following the ligation and injection. The operation advocated by Linton[14] is advised in the former and ligation of the saphenous vein in the popliteal space in the latter.

TECHNIQUE OF TREATMENT

1. *Injection Technique.* Before any attempt is made to produce an obliteration of a varix by injection the contraindications to this form of therapy should be ruled out. Systemic diseases, infirmity, hyperthyroidism, general or local infection, impairment of the deep or arterial circulation are all contraindications; and injection should not be done until such conditions have been corrected or cured.

Thus far no ideal sclerosing solution has been found; each has some undesirable features. A few which have proved satisfactory are 5 per cent sodium morrhuate, dextrose 50 per cent, potassium oleate 5 per cent, and monolate. We are now using this latter solution exclusively. All these substances are toxic to some degree depending upon the sensitivity of the patient and dosage. Severe reactions have been reported following the injection of some of these solutions[14] and large doses must not be given.

The varicosities to be injected are located by having the patient stand and

marking areas where injections are to be made with antiseptic dye such as gentian violet or mercurochrome. The patient lies down and the veins are distended by placing a tourniquet just above the knee. A 24 or 25 gauge needle is inserted into the vein at the marked area, and the tourniquet is released. The blood is stripped from this segment of the vein and the necessary amount of sclerosing solution is slowly injected through the needle. Sterile gauze is placed over this area supported by an ace bandage which is worn continuously during the period of treatment. Injections may be repeated twice weekly, using alternate legs. Two to five veins may be injected at a time, the number depending upon the amount of reaction the patient manifests.

2. *Ligation and Section of the Saphenous Vein.* A. Saphenofemoral Junction. Palpation of the femoral artery locates the saphenous vein, as the saphenofemoral junction is about 2 cm. medial to the femoral artery and 2 cm. below Poupart's ligament. With aseptic technique a local anesthetic is injected and an incision about 2 inches long made over the saphenous vein parallel to Poupart's ligament. The saphenous vein lies underneath the superficial fascia and the latter must be divided and retracted before the vein can be found resting in fatty tissue. The saphenofemoral junction is exposed with the several tributaries of the saphenous vein. The tributaries of the vein are tied and the vein itself is dissected free to its junction with the femoral vein. It is then doubly ligated so that about 1 inch of the vein can be removed between the ligatures. Each end of the vein is transfixed, using No. 1 chromic catgut suture. The distal segament of the vein is injected with the selected sclerosing agent and the wound is closed. A pressure dressing is applied and the patient is encouraged to walk as soon as he desires. If any varicosities remain they may be injected, beginning one week following the ligation and the section.

B. Lower Portion of the Vein below Its Communicating Branches. The saphenous vein in this area lies along the posterior border of the medial condyle and may be found by making a transverse incision at this point. There are a few superficial veins which may be mistaken for the saphenous. The latter lies under the superficial fascia, however, and if this fact is kept in mind error will not occur.

C. Medial Portion between Upper and Lower Ligations. The saphenous vein is located in this area by having the patient stand before the leg is prepared for surgery. It can be found by the Schwartz test. The vein site is marked with an indelible pencil and ligation and injection are easily accomplished by the above technique.

REFERENCES

1. Ochsner, A., and Mahorner, H. R. The modern treatment of varicose veins. *Surgery*, 2: 889, 1937.
2. Levenson, W. S. High ligation in the treatment of varicose veins. *New England J. Med.*, 213: 972, 1935.
3. Sarma, P. J. Saphenous vein ligation. *S. Clin. North America*, P. 129 (Feb.) 1938.
4. Veal, J. R., and Van Werden, B. D. The physiologic bases for ligation of the great saphenous vein in the treatment of varicose veins. *Am. J. Surg.*, 40: 426, 1938.
5. Homans, J. Textbook of Surgery. Springfield, 1932. C. C. Thomas.
6. Trendelenberg, F. Ueber die Unterbindung der Vena saphena magna bei Unterschenkelvaricen. *Beitr. z. klin. Chir.*, 7: 195, 1891.
7. Perthes, G. Uber die Operation der Unterschenkelvaricen nach Trendelenberg. *Deutsche med. Wchnschr.*, 1: 253, 1895.
8. Lowenberg, E. L. Varicose veins treated by combined ligation and injection. *Surgery*, 2: 903, 1937.
9. Whitney, E. T., and Consales, P. A. The treatment of the varicose ulcer. *New England J. Med.*, 213: 967, 1935.
10. Brown, J. B., Byars, L. T., and Blair, V. P. Study of ulcerations of lower extremities and their repair with thick split skin grafts. *Surg., Gynec. & Obst.*, 63: 273, 1936.
11. Edwards, E. A. Thrombophlebitis of varicose veins. *Surg., Gynec. & Obst.*, 66: 236, 1938.
12. Whitney, E. T. Treatment of phlebitis. *New England J. Med.*, 213: 970, 1935.
13. Edwards, E. A., and Edwards, J. E. Effect of thrombophlebitis on venous valve. *Surg., Gynec. & Obst.*, 65: 310, 1937.
14. Linton, R. R. Communicating veins of the lower leg and the operative technic for their ligation. *Ann. Surg.*, 107: 582, 1938.
15. Traub, E. F., and Swarts, W. B. Collapse complicating varicose vein injection of sodium morrhuate. *New York State J. Med.*, 37: 1506, 1937.

CASE REPORTS

MALIGNANT HICCUP*†

WITH REPORT OF A CASE FOLLOWING TRANSURETHRAL PROSTATIC RESECTION AND REQUIRING BILATERAL PHRENICECTOMY FOR CURE

MEREDITH F. CAMPBELL, M.D.

NEW YORK CITY

PERSISTENT hiccup often threatens life by exhaustion; this severe variety is entitled to the designation malignant. Hiccup or singultus is produced by an intermittent spastic contraction of the diaphragm causing inspiration which is followed by a sudden closure of the glottis. The motor impulse in the usual hiccup travels over the phrenic nerve which arises at the third and fourth cervical spinal cord levels and is the most important branch of the cervical plexus. Occasionally clonic contraction of the accessory muscles of respiration (intercostal, abdominal) assists in producing hiccup and even may produce hiccup following bilateral phrenicectomy, especially in cases of central nervous system origin.[1] It is evident that the same muscles which function to produce hiccup operate also in vomiting but with different action. Thus sensory impulses carried by vagus fibers from irritant lesions of the larynx and other structures correspondingly innervated, may reflexly cause hiccup.[2]

An extensive study of the literature suggests that the clinico-therapeutic course of the patient herewith reported is unique. In a 76 year old man prolonged hiccup complicated recovery from an otherwise uneventful transurethral resection of an adenomatous prostate gland. The hiccup not only failed to respond to the more rigorous types of non-surgical treatment but finally required bilateral removal of the phrenic nerves (phrenicectomy) to prevent death from exhaustion. A briefly detailed report of the clinical course and the varied therapy employed indicates (1) methods of treatment of hiccup and some of the potential therapeutic difficulties to be encountered; (2) the severe physical depletion persistent hiccup may induce and (3) the likely ultimate desperation of patient and physician alike. It will be noted that during an eight day period, this old gentleman suffered thirty-nine separate attacks of severe hiccup, even during sleep; the longest continuous spell was twenty-one and a half hours.

CASE REPORT

F. S., a retired teacher, 76 years of age, presented himself October 18, 1934 because of difficulty and frequency of urination of gradually increasing severity during the previous fifteen years. During the day he urinated every two hours, he voided two to three times nightly, suffered some urgency with periodic hesitancy, occasionally urinary dribbling and perineal pain. Ten years previously he had hiccupped intermittently for several days following inguinal hernioplasty.

Urologic examination disclosed 2 ounces of residual urine; the voided urine was clear, the specific gravity was 1.022, albumin graded one plus was found, and an occasional leucocyte. By rectum the prostate felt twice normal size and was smoothly elastic. Cystoscopy revealed a moderate adenomatous hypertrophy of the

* From the Departments of Urology, New York University College of Medicine and Mountainside Hospital, Montclair, New Jersey.

† Read before the Section on Urology, New York Academy of Medicine, January 16, 1938.

median prostatic lobe. Lateral prostatic lobe hypertrophy was graded two plus; hypertrophy of the trigone and moderate generalized trabeculation of the bladder wall completed the cystoscopic picture.

On October 24 the patient was sent to Mountainside Hospital. The nonprotein nitrogen was determined to be 31.59 mg. per 100 c.c. of blood and the CO_2 plasma combining power 56 volumes per cent.

On October 25 under low spinal anesthesia bilateral vasectomy and transurethral prostatic resection were performed. The middle prostatic lobe and the adjacent lower segments of the lateral lobes were generously excised; the removed tissue was not weighed. There was slight bleeding; a 24 F. catheter was left indwelling.

The patient was returned to his bed where he was given an intravenous infusion of 1300 c. c. of normal saline. In the afternoon 500 c. c. of normal saline and 500 c. c. of 10 per cent glucose were given intravenously. During the day the patient excreted 450 c. c. of urine. That night he vomited 150 c. c. of fluids and the following morning complained of gas pains which were partially relieved by a flaxseed poultice and rectal tube. In the afternoon of the first day postoperative, 1500 c. c. of normal saline-5 per cent glucose was again given hypodermically and flaxseed poultices together with an inlying rectal tube were again employed because of moderate abdominal distention. That night (second postoperative) there was emesis of small amounts of bile stained fluid, but this was temporarily checked by an opium derivative (pantopon) hypodermically.

The following morning, forty-four hours postoperative, the patient hiccupped for fifteen minutes and from this point, the complicating hiccup and its treatment can most briefly be recorded in a tabular manner. During the eight day period of exhausting hiccupping the fluid intake (chiefly intravenous) varied between 2,430 and 3,470 c. c. in twenty-four hours. Also not indicated in the tabulation of hiccup was the diligent and almost exhausting use of of the commonly employed procedures to combat abdominal distention. This included enemas (soapsuds, soda bicarbonate, milk and molasses), pitressin hypodermically, hot abdominal poultices, inlying rectal tube, gastric lavage and inlying Levine gastric tube. Stimulation was often necessary; caffeine sodium

Date	Hour	Event	Treatment
10/25.....	11 A.M.	Prostatic resection	
10/27..... (Second postop. day)	7:50 A.M.	Hiccup began, 15 minutes	Deep breathing and blowing into paper bag (rebreathing). No result. 98 per cent CO_2 breathing through anesthesia respirator for three minutes.
	8:15 A.M.	Hiccup stopped	
	10:45 A.M.	Hiccupping	CO_2 breathing for five minutes without effect.
	12:30 P.M.	Hiccupping	CO_2 breathing for five minutes without effect.
	1:40 P.M.	Hiccupping stopped	Flaxseed poultice with rectal tube.
	1:50 P.M.	Hiccup resumed	Inhalation of pure oxygen. No effect. Blood pressure 128/60 mm. Hg.
	3:05 P.M.	.....	Inhalation CO_2.
	3:10 P.M.	Hiccup stopped	
	4:15 P.M.	Hiccup resumed	CO_2 rebreathing five minutes.
	4:20 P.M.	Hiccup stopped	
	5 P.M.	Hiccup resumed	
	7:45 P.M.	Hiccupping and distention	Levine tube passed and fastened in situ; connected with continuous suction drainage. Hiccup stopped for forty-five minutes
	8:30 P.M.	Hiccup resumed, weakness	Levine tube removed. Caffeine sodium benzoate gr. 5.
	11 P.M.	Hiccup stopped	
	12 P.M.	Hiccup resumed	Sodium pentobarbital gr. 1½.
10/28..... (Third postop. day)	12:30 A.M.	Hiccup stopped	
	3 A.M.	Hiccup resumed	CO_2 and oxygen for fifteen minutes.
	4 A.M.	.....	Pantopon gr. ⅙, hypo.
	4:15 A.M.	Hiccup stopped while sleeping	
	5 A.M.	Hiccup resumed	
	7 A.M.	More cheerful, abdomen soft, complaining of "acid stomach"	
	7 A.M.	Hiccup ceased	
	8 A.M.	Hiccup resumed	Pitressin 1 ampule
	9 A.M.	.....	Uvula painted with tincture of iodine.
	9:05 A.M.	Hiccup stopped	
	9:10 A.M.	Hiccup resumed	Rhubarb and soda 2 drams: no effect. Blowing into paper bag: no effect.
	10:45 A.M.	.....	Blowing into empyema blow bottles. Hiccup stopped after twenty-five minutes of this.
	11:10 A.M.	Hiccup stopped	
	12:30 P.M.	Hiccup resumed	Use of blow bottles was ineffective, but patient stopped hiccupping some time later.
	1 P.M.	Hiccup stopped	
	4:30 P.M.	Hiccup resumed	
	6:30 P.M.	Hiccup ceased	Blow bottles used but hiccup recurred in a few minutes.
	6:35 P.M.	Hiccup resumed	

Date	Hour	Event	Treatment
	9 P.M.	.....	Sodium pentobarbitol gr. 1½.
	9:15 P.M.	Hiccup stopped	
	10:30 P.M.	Hiccup resumed	
	11:30 P.M.	.....	Pantopon gr. ⅓
10/29..... (Fourth postop. day)	4 A.M.	.....	Pantopon gr. ⅓. Patient slept about ninety minutes after narcotic but hiccup continued.
	8 A.M.	Abdominal distention	Pitressin, 1 ampule.
	9 A.M.	Still hiccupping	Levine tube reinserted. Magnesium sulfate 2 ounces through tube.
	10 A.M.	Hiccupping	Mustard paste to anterior chest for fifteen minutes. Tincture of benzoin inhalations.
	12:30 P.M.	.....	98 per cent CO_2 breathing.
	12:40 P.M.	Hiccup stopped	
	1:20 P.M.	Hiccup resumed	98 per cent CO_2 breathing. No effect.
	2 P.M.	.....	Morphine sulfate gr. ¼.
	2:15 P.M.	Hiccupping	Mustard paste to anterior chest. Tincture benzoin inhalations.
	3:30 P.M.	Still hiccupping	Oil of cajeput 2 minims in 1 teaspoonful of sugar.
	4 P.M.	.....	Pitressin, 1 ampule.
	4:30 P.M.	Hiccupping stopped	
	5 P.M.	Hiccup resumed	
	5:45 P.M.	.....	Mustard paste to anterior chest, tincture of benzoin inhalations.
	6:40 P.M.	Hiccup continued	Very weak. Hypodermic hyoscine hydrobromide gr. 1/100, morphine sulfate gr. ⅙, caffeine sodium benzoate gr. 2.
10/30..... (Fifth postop. day)	2:30 A.M.	.....	Sodium pentobarbitol gr. 1½. Pantopon gr. ⅓. Still hiccupping though sleeping for two hours.
	3:30 A.M.	.....	98 per cent CO_2 rebreathing for five minutes. Hiccup continued.
	8 A.M.	.....	Pitressin, 1 ampule.
	12 A.M.	.....	Avertin rectal anesthesia profound. Hiccup continued.
	2:30 P.M.	.....	Oil of cajeput minims 2 on 1 teaspoonful sugar.
	2:35 P.M.	Hiccup stopped	
	2:40 P.M.	Hiccup resumed	
	4:45 P.M.	.....	5 minims chloroform in 1 dram aromatic elixir. Depressed, crying, spitting blood.
	6:30 P.M.	.....	5 minims chloroform in 1 dram aromatic elixir.
	7:10 P.M.	Hiccupping	Atropine sulfate gr. 1/100. Tincture benzoin inhalation. Shallow breathing.
	7:20 P.M.	Hiccup stopped	
	8:20 P.M.	Hiccup resumed	
	8:40 P.M.	.....	Atropine sulfate gr. 1/150. Surgical ether anesthesia.
	10:45 P.M.	Hiccup stopped	
10/31..... (Sixth postop. day)	12:30 A.M.	Hiccup resumed	
	1:30 A.M.	.....	Atropine sulfate gr. 1/150.
	3:30 A.M.	.....	Inhalation of CO_2 for thirty minutes.
	10 A.M.	Hiccup continued	Indwelling catheter removed. Atropine sulfate gr. 1/100. Diathermy to posterior chest.
	12 M	.....	Atropine sulfate gr. 1/100.
	1:00 P.M.	Hiccup ceased	
	2:00 P.M.	Hiccup resumed	Infusion 2,250 c.c. saline 5 per cent glucose intravenously, containing 1.5 ounces of 10 per cent novocaine. Diathermy to posterior chest.
	2:30 P.M.	.....	Atropine sulfate gr. 1/100. Patient sleeping at long intervals but still hiccupping.
	9 P.M.	Still hiccupping	Calomel gr. 3; soda bicarbonate gr. 10; benzyl benzoate drams 2 in 4 ounces water and 2 drams sugar.
11/1..... (Seventh postop. day)	12:30 A.M.	.....	Hyoscine hydrobromide gr. 1/150; morphine sulfate gr. ⅓; caffeine sodium benzoate gr. 2 by hypodermic.
	12:35 A.M.	.....	Surgical chloroform anesthesia (5 ounces).
	12:45 A.M.	Hiccup ceased	
	1 A.M.	.....	Avertin rectal anesthesia.
	3:30 A.M.	Hiccup resumed	
	6:30 A.M.	Hiccup continued	Avertin rectal anesthesia.
	9 A.M.	.....	Benzyl benzoate 2 drams with 2 drams sugar in 4 ounces water.
	10 A.M.	.....	Sodium bicarbonate enema followed by turpentine stupes and later by tight abdominal binder.
	10:40 A.M.	.....	Sodium amytal gr. 3. Periodically irrational; incontinent.
	11 A.M.	Hiccup stopped	
	11:10 A.M.	Hiccup resumed	
	11:30 A.M.	.....	Hypodermoclysis of normal saline—5 per cent glucose 2,250 c.c. and 1½ ounces 10 per cent novocaine.
	11:40 A.M.	.....	Sodium amytal gr. 3. Abdominal belt tightened.
	1:10 P.M.	Hiccup continued	Sodium bromide gr. 60, chloral hydrate gr. 25, by rectum.

Date	Hour	Event	Treatment
			Expelled thirty minutes later.
	3:30 P.M.	.....	Sodium amytal gr. 3. Snoring noisily but still hiccuping.
	4:15 P.M.	Hiccup ceased	
	4:50 P.M.	Hiccup resumed	
	6 P.M.	Hiccup ceased	Turpentine abdominal stupes.
	8:15 P.M.	Hiccup resumed	Patient sleeping; confused; irrational at times.
	9 P.M.	.....	Sodium amytal gr. 3. Hiccup continued.
	11:45 P.M.	Hiccup ceased	
11/2..... (Eighth postop. day)	12:20 A.M.	Hiccup resumed	Abdominal belt replaced.
	12:40 A.M.	.....	Sodium amytal gr. 3.
	1:15 A.M.	Hiccup stopped	
	1:45 A.M.	Hiccup resumed	
	7:40 A.M.	Hiccup ceased	
	8:30 A.M.	Hiccup resumed	
	9 A.M.	.....	CO_2 estimation 58 volumes per cent and NPN 31.59 mg. per 100 c.c. of blood.
	10:30 A.M.	Hiccup continued	Sodium amytal gr. 3.
	10:45 A.M.	Hiccup ceased	
	12:55 P.M.	.....	Sodium amytal gr. 3.
	1:40 P.M.	.....	Saturated alcoholic solution of menthol 10 minims.
	2:40 P.M.	.....	Saturated alcoholic solution of menthol 10 minims.
	3:40 P.M.	.....	Saturated alcoholic solution of menthol 10 minims.
	3:45 P.M.	Hiccup resumed	
	4:40 P.M.	.....	Saturated alcoholic solution of menthol 10 minims.
	5 P.M.	.....	Saturated alcoholic solution of menthol 10 minims. Whiskey drams 2 in eggnog.
	9:30 P.M.	Hiccup continued	Chloral hydrate gr. 40, triple bromides gr. 60 by rectum.
	10:30 P.M.	.....	Sodium amytal gr. 3.
	11:45 P.M.	Hiccup ceased	
11/3..... (Ninth postop. day)	12:15 A.M.	Hiccup resumed	
	2:45 A.M.	.....	Sodium amytal gr. 3
	3:30 A.M.	Hiccup ceased	
	4:30 A.M.	Hiccup resumed	
	7 A.M.	Hiccup ceased	Restless, disoriented.
	9:30 A.M.	Hiccup resumed	
	10:15 A.M.	.....	Morphine sulfate gr. ¼, atropine sulfate gr. 1/100.
	2 P.M.	Hiccup ceased	
	4 P.M.	Hiccup resumed	
	5 P.M.	Hiccup ceased	
	5:15 P.M.	Hiccup resumed	
	7:50 P.M.	Operation (by the late Dr. Pol Coryllos, called in consultation): Novocaine (1 per cent) injection and crushing of left phrenic nerve, the left side of the diaphragm appearing to be the pacemaker. Branches to the fourth cervical root (two), subclavius muscle (one), and scalenus muscle (one) were cut. Hiccup temporarily stopped soon after injection of novocaine into the deep cervical fascia. Before crushing the nerve, its identity was verified by contraction of the diaphragm produced by clamping the nerve. Following left phrenicectomy, the left pupil became larger than the right.	
	9:30 P.M.	Hiccup resumed	
	10 P.M.	.....	Morphine sulfate gr. ¼, atropine sulfate gr. 1/150.
	10:45 P.M.	.....	Oratol gr. 3.
	10:50 P.M.	Hiccup ceased	
11/4..... (Tenth postop. day)	1:40 A.M.	Hiccup resumed	
	3:40 A.M.	.....	Morphine sulfate gr. ¼, atropine sulfate gr. 1/150.
	6:10 A.M.	Hiccup ceased	
	7:45 A.M.	Hiccup resumed	
	8:45 A.M.	Hiccup ceased	
	9:15 A.M.	Hiccup resumed	
	12:30 P.M.	Operation, bilateral phrenicectomy (Dr. Pol Coryllos). Cutting of all visible rami and crushing of right phrenic nerve scarcely influenced the hiccup, therefore evulsion was decided upon and the nerve, 12 inches long, was removed. Hiccup persisted. The left operative wound of the day previous was reopened and the phrenic nerve (13 inches) was evulsed. It was only when 3 inches of the nerve had been pulled out by rolling on a clamp that the hiccup stopped. Following evulsion, hiccup stopped permanently.	

benzoate was employed. An ineffective effort was made to maintain nutrition by the administration of readily digestible foodstuffs of high caloric value.

From this point the convalescence was that of a greatly debilitated aged patient. An electrocardiographic study on November 5 was considered normal. Examination of the chest showed a mild consolidation (dullness, bronchial breathing, egophony, pectorilloquy) of the left lower lobe posteriorly. Fluoroscopic examination revealed marked elevation of the diaphragm coincident to atonic relaxation. The patient continued to have moderate postoperative irritability of the vesical outlet and posterior urethra. Blow bottles were employed for a few minutes every hour during which the patient was awake. The temperature curve ranged between 99°F. and 101 except on the ninth day and immediately following bilateral phrenicectomy on which occasion it reached 102.6°F. Thereafter it promptly became normal and remained so until the patient was discharged from the hospital. He was able to sit on the edge of his bed November 11 and was out of bed two days later, returning home on November 24, exactly one month after entering the hospital.

Since leaving the hospital he has been about regularly, attends to household chores and the furnace, shovels snow, works in his garden, goes to camp in the summer and performs other activities of which few men of his years are

capable. He has a slight dyspnea on exertion; he exhibits paradoxical breathing (abdominal relaxation and protrusion on inspiration) and still complains of some urinary frequency. When examined urologically one year ago his urine showed scattered leucocytes; rectal examination disclosed no important prostatic change during four years and he emptied his bladder completely. Today at 81 years he is still seen on the streets, though he is, of course, in his dotage.

DISCUSSION

Hiccup is a neuromuscular reflex mechanism and may be caused by any irritation (1) of the afferent pathway to the phrenic nerve centers in the upper cervical cord, (2) of the cord and central centers themselves, or (3) of the efferent pathways to the muscles whose clonic contraction produces hiccup. Examples of these etiologic groups are indicated in the following:

1. *Afferent Nerve Irritation.* Gastrointestinal tract: Swallowing of irritating or hot fluid or food, esophogeal or gastric lesions (esophagitis, gastritis, gastric distention), bowel distention, obstruction, ileus, strangulated hernia, acute appendicitis, typhoid, acute pancreatitis, acute biliary and hepatic lesions, peritonitis.

Pulmonary tract: laryngitis, bronchitis, pneumonia, tumors, empyema, pleurisy, phrenic and subphrenic inflammation and abscesses. As noted in the introductory paragraph, hiccup and vomiting are produced by contraction of the same muscles and any lesion which induces irritation of vagus sensory filaments may reflexly cause hiccup.

Mediastinal lesions: inflammations, adhesions, abscesses, tumors, caseous glands, cardiac enlargement, aortic aneurysm,[3] adhesive pericarditis. Pulmonary and mediastinal lesions may also cause hiccup through direct irritation of the phrenic nerve or of the diaphragm.

2. *Central Irritation.* Primary or metastatic cerebral or medullary tumors may directly or reflexly induce hiccup. The third and fourth cervical spinal roots may be irritated by (1) meningeal lesions such as syphilitic meningitis, (2) cervical pachymeningitis, (3) disease of the surrounding vertebrae, such as dislocation, fracture, tumor or spondylitis. Central perineuritis may result as a centripetal extension along the phrenic nerve from pleural and diaphragmatic inflammation.

3. *Efferent Nerve Irritation.* As indicated in the second preceding paragraph, lesions of or adjacent to the phrenic nerve may be etiologic in producing hiccup.

Acute or chronic alcoholism may cause gastric irritation, toxic encephalitis or neuritis. Sulfanilamide[4] and serum sickness (anthrax antiserum[5]) have also been reported as toxic causes. Byrnes[6] observed crises of hiccups in tabes dorsalis. Psychogenic hiccup is occasionally observed in nervously unstable patients, may last a week or more, but always ceases during eating. My patient hiccupped during meals and sleep.

TREATMENT

In most instances treatment can properly be directed against the etiologic irritative factor. Yet the fact that more than 200 remedies have been advocated attests to the frequent therapeutic difficulties.

Simple and commonly employed treatment of hiccup includes physical or psychic counter-irritative methods such as firm prolonged traction of the tongue, application of an ice cap to the neck, tickling the inner nares with a feather, painting the uvula with tincture of iodine or other irritant, inhaling fumes of ether, chloroform, nitroglycerine or smelling salts, drinking cold water from the far side of a glass, drinking undiluted whiskey (1 ounce or so), Worcestershire sauce, or other gastric irritant, pressure on the phrenic nerves between the heads of the sternocleidomastoid muscles, pressure on the upper lip, eyeballs or on the ribs near the origins of the diaphragm, holding the breath as long as possible, a sudden fright, electric stimulation of the phrenic nerves, epigastrium and abdominal muscles, spraying ethyl chloride over the epigastrium

and upper abdomen, and deep diathermy to lower chest. Blowing into a paper bag (modified CO_2 rebreathing) is often successful in stopping hiccup and direct rebreathing of 90 per cent oxygen or of 98 per cent CO_2 using a regular closed anesthesia mask is even more likely to succeed. This was extensively employed with my patient. This patient also received periodically for two days a mixture of 5 minims of chloroform in 1 dram of aromatic elixir.

When postoperative or other types of gastrointestinal distention cause the hiccup, pitressin, prostigmin, hot stupes, medicated enemas, gastric lavage or intestinal decompression by periodic or continuous suction through a Levine gastric tube, may be effective. In the case reported here, postoperative gastrointestinal dysfunction and distention seem the likely explanation of the hiccup. The history of persistent though milder hiccup after herniotomy ten years before suggests a low threshold of hiccup reflex.

It is likely that in many cases of prolonged hiccup disturbances of fluid and salt balance may play an etiologic role. Dr. Max Peet, neurosurgeon to the University of Michigan Hospital writes[7] "I have seen a number of old men who developed hiccup after a prostatic resection, but in every instance we were able to overcome the hiccup by giving very large quantities of fluid intravenously. Usually 5000 to 6000 c.c. were given in twenty-four hours. The results in some cases were miraculous." This is a valuable therapeutic hint and had we known, we might have successfully employed it. In our case, the fluid intake was kept moderate (2,430–3,470 c.c. in twenty-four hours) simply to meet estimated fluid requirements and to prevent cardiac overloading in an aged patient. The intravenous administration of hypertonic sodium chloride solution (e.g., 50 c.c. of a 20 per cent solution) with a view to stimulation of intestinal peristalsis was considered but consensus ruled against.

Vomiting induced by the administration of apomorphine gr. $\frac{1}{8}$ (adult) may help to evacuate the intestinal tract and remove the irritative focus; Byrnes[6] suggests giving 20 gr. of zinc sulfate with the apomorphine. Hyoscine hydrobromide gr. $\frac{1}{100}$ may afford adequate sedation. Yet morphine is best except when inflammation of the higher centers exists, as, for example, in epidemic encephalitis; in such cases spinal tap may give relief. The antispasmodic effect of benzyl benzoate (2 c.c. of 20 per cent solution) has sometimes checked hiccup. Shaine[8] has recently reported cessation of persistent hiccup 15 to 20 minutes following the hypodermic administration of 10 to 20 mg. of benzedrine sulfate (benzyl methyl carbinamine or beta-phenylisoprophylamine sulfate) which relaxes the smooth muscle of the gastrointestinal tract. Antiluetic therapy has stopped persistent hiccup in tabes.[6,9] The ingestion of aromatic oils has been recommended; these include oil of peppermint (oleum menthol piperitae), oil of lavendar (oleum lavendula), oil of orange (oleum aurenti), oil of ginger (oleoresina zingiberis) and as used in the case here reported oil of cajeput (oleum cajeputi).

When the primary irritative lesion cannot be identified or cannot be adequately controlled, drugs may be administered to minimize irritant sensory impulses and reflex reactions. These medications include the barbituric acid derivatives, morphine and other opium derivatives, and in severe cases, general anesthetics such as avertin, nitrous oxide, ethylene or even chloroform. In the case of the elderly patient here reported, deep surgical anesthesia induced once with ether and again with chloroform was utterly ineffective. Spinal anesthesia may successfully block the hiccup producing reflex arc in severe persistent intestinal, and particularly peritoneal irritative lesions. A tight abdominal binder will reduce somewhat the severe physical strain and fatigue consequent to the continuous muscular exertion.

When, as in our case, conservative methods of treatment fail and the condition of the patient becomes critical, injection

of one or both phrenic nerves with novocaine (1 to 5 per cent) may permanently stop the hiccup; in any event it will usually stop hiccup for two or three days. If injection fails, nerve crushing or even phrenicectomy must be resorted to. Operation on the phrenic nerve to be effective must include division of all of the filaments; anomalous radicles may be overlooked. In the case here reported the left side of the diaphragm was apparently the pacemaker, hence this phrenic nerve was attacked first.

Unilateral paralysis of the diaphragm produces no symptoms; bilateral paralysis results in dyspnea on exertion and sometimes even when the patient is at rest. Moreover, in bilateral phrenic paralysis coughing and straining at stool are often unsatisfactorily performed; chronic congestion of the base of the lungs also results. Yet the aged patient here reported suffered these handicaps to an amazingly slight degree and owes his relatively active existence to bilateral phrenicectomy.

SUMMARY

A case is reported of persistent hiccup requiring bilateral phrenicectomy for cure. The mechanics of the hiccup reflex mechanism are discussed together with the various advocated methods of treatment. Although hiccup is usually a simple transient disturbance which readily responds to conservative treatment, persistent hiccup may seriously threaten life. In the last circumstance, phrenic nerve injection, crushing, or excision—unilateral or bilateral—is indicated and is often life saving. The phrenic nerve surgery is best entrusted to an experienced thoracic surgeon.

REFERENCES

1. Kappis, M. Origin and treatment of hiccup. *Klin. Wchnsbr.*, 3: 1065, 1924.
   Goetz, O. *Zentralbl. f. Chir.*, 47: 1290, 1920.
2. Felix, W. Anatomische, experimentalle und klinische Untersuchungen über den Phrenicus und über die Zwerchfellinnervation. *Deutsche Ztschr. f. Chir.*, 283: 171, 1922.
3. Bercovich, A., and Charosky, L. Phrenicotomy in incoercible hiccup due to aortic aneurysm. *Prensa med. argent.*, 23: 2436, 1936.
4. Wyman, M. H. Unusual reaction to sulfanilamide. *Southb. M. & S.*, 100: 15, 1938.
5. Mironescu, T., and Lazarescu, A. Le hoquet postsérothérapique. *Bull. et mém. Soc. méd. d. hôp. de Paris*, 52: 731, 1936.
6. Byrnes, C. M. Hiccup crises in tabes dorsalis. *Bull. Johns Hopkins Hosp.*, 56: 264, 1935.
7. Peet, M. Personal communication.
8. Shaine, M. S. Benzedrine sulfate in persistent hiccup. *Am. J. M. Sc.*, 196: 715, 1938.
9. Kroh, F. *Münchcn. med. Wchnscbr.*, 69: 807, 1922.

CONGENITAL MALIGNANT TUMOR OF THE SKIN IN THE NEWBORN

REPORT OF CASE

A. M. FICHMAN, M.D.

FORT WAYNE, INDIANA

CONGENITAL malignant tumor of the skin in the newborn is so rarely seen that when this condition is found it may not be recognized as such. Little attention is given it until the growth has either spread or metastasized to such an extent that diagnosis offers no problem, but the outcome is usually fatal.

Reference to the literature on congenital malignant tumors in the newborn yields a dearth of reports of such cases. However, there are many reports of neoplasms other than of the skin occurring in childhood and youth. The earliest report which we have been able to find of a case of congenital malignant tumor of the skin is by Ritter[1] in 1864. He described a case of proliferating carcinoma of the skin over the tip of the nose in a nursling of a few months. He commented that since neither the cartilage nor the epidermis was the site of origin of the tumor, it must be assumed that the origin was in the connective tissues of the cutis. On the basis of this comment it is apparent that this was a case of sarcoma rather than carcinoma. Korte,[2] Bedford,[3] and Anzilotti[4] each reported single cases of congenital malignant tumor of the skin in the newborn. Bedford's case, however, was metastatic due to carcinoma of the thymus.

That congenital malignant tumors other than of the skin occurring in the newborn, though not rare, are not common is shown by the few reports in the literature. Pearl[5] finds that in 6,670 necropsies 12.2 per cent showed some form of malignancy but none in the newborn. Anzilotti[4] in his article mentions Stubiger who collected five cases. Schorr and Stahr each described single cases while Teri[6] reported on three cases. Dudits and Szabo,[7] Lain,[8] Colloridi,[9] Canavan and Hemsath,[10] and Frank and his associates[11] reported single instances of congenital malignant tumors in the newborn. Lain, in reviewing the literature pointed out that "the periodical literature contains little on the subject of congenital cancer." He quoted Roger W. Williams as stating in 1908 "that prenatal life, infancy and childhood are completely exempt from malignant epithelial tumors" and adds "that in spite of a few exceptional cases of this kind it may be safely asserted that, under the age of puberty cancer is practically unknown."

Phillip[12] reviewed the literature and collected sixteen cases of non-congenital growth comprising 17 per cent of all types of malignancy. In most of these cases the growths developed on a basis of xeroderma pigmentosa; some developed spontaneously. The majority were squamous cell carcinoma. Rosner[13] in his statistics included 4,513 patients with cancer of the skin or natural orifices. Of these, twenty-two cases occurred between the ages of 1 and 10 years. Nothing is said about skin cancer in the newborn. Duzan[14] analyzed the regional distribution of 182 malignant tumors in early infancy and found none in the skin, while Picot[15] found only eight cases of skin cancer in 424 malignant tumors of early infancy. Dean and Pack[16] reported on 155 malignant tumors in patients under ten years of age at the Memorial Hospital (New York) and found only four in the skin, but they did not state whether any of these were congenital or in the newborn. They cite D'Espine and Piso who studied the regional distribution of 393 malignant tumors in children and found none in the skin. Pack and LeFevre[17] reported on 19,129 patients with neoplastic disease accepted for treatment at the

Memorial Hospital from January 1, 1917, to January 1, 1929. Of these tumors 16,565 were malignant. They found that 5 per cent of patients admitted to Memorial Hospital had "epidermoid carcinoma of the skin." "Only 0.64 per cent were individuals under 25 years (seven instances); of these, the youngest was a male infant 15 months, whose tumor was embryonal in character." Here, again, the rarity of congenital malignant tumor of the skin in the newborn is brought out by the fact that out of 16,565 patients with malignant tumors, there were none with malignancy of the skin in the newborn.

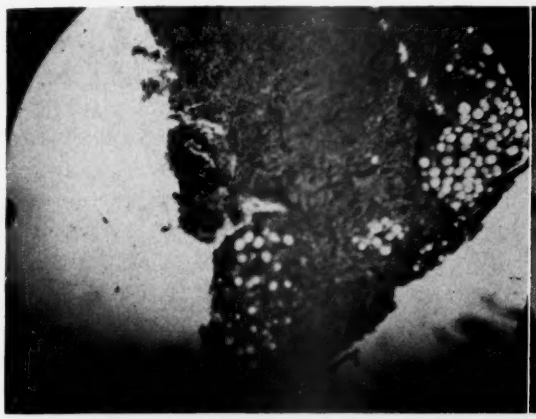


Fig. 1. Low power, showing general pattern of typical malignant tumor cells and some fat cells.

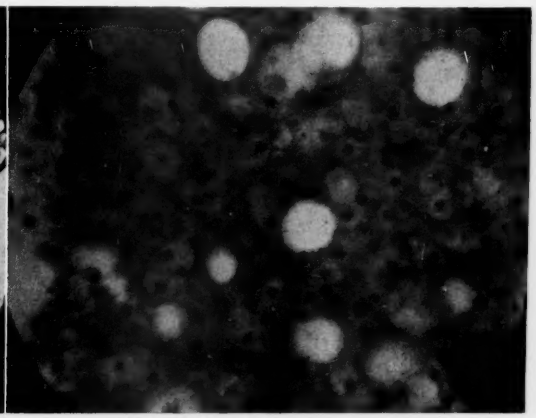


Fig. 2. High power, showing large round polyhedral cells, with densely staining nuclei, mitosis and metaplasia into fat cells.

Cancers in youth when compared with similar tumors in mature or later life are more rapidly growing, and of greater malignancy. The history of the disease is short, the course is rapid and the mortality high. Rankin and Broders[18] state "that active tissue of youth, instead of resisting cancer invasion, invites its spread and the young person who is host to a malignant neoplasm has little chance for longevity, regardless of the type of therapeutic measures instituted." Pack and LeFevre[17] believe that "inheritance is not as important a factor in the genesis of the malignant tumors of childhood as the congenital influence of misplaced, embryonal cell rests."

REPORT OF CASE

S. W., male, of Jewish parentage, was born at the Methodist Hospital, August 22, 1937, a full term with eutocic birth. The antenatal period had been uneventful, and there was no history of familial disease or neoplasms. At the time of birth a small tumor in the skin at the left posterior axillary fold was noticed. However, the child appeared well developed, weighed 6 pounds, and cried lustily. It was examined for any abnormalities or malformations, and aside from the tumor in the left posterior axillary fold, none were found.

The tumor was pale bluish-red in color, slightly larger than a five cent piece; it was sharply demarcated in the skin, and but very slightly, if at all, elevated. The surrounding skin appeared normal in color, texture and elasticity. The tumor felt somewhat hard and resistant, and was fixed in the skin; its depth could not be determined, but it was not fixed to the underlying structures. It was apparently not painful, as pinching or pressure over the growth did not cause the baby to cry.

Two days after birth the tumor and the surrounding skin for about 3 cm. assumed an inflammatory appearance as in a localized cellulitis. The adjacent skin became red, infiltrated, warmer, and less pliable than normal. There was no fever. This condition persisted for about two days and then subsided, leaving the tumor and surrounding skin as at birth.

A circumcision was done on the eighth day in conformity to the religious rite. The wound healed normally in about five to six days. Roentgen examination of almost the complete torso of the child showed no bone changes or any other pathology.

During the next five weeks the child progressed normally, gained weight, and seemed healthy. Examination at the end of this time

showed a decided alteration in the appearance of the tumor. Its color had changed from the original pale bluish-red to a grayish yellow. The surface, which at birth was smooth and even, felt nodular. The tumor as a whole did not appear to have increased in size, nor had it become more elevated above the surrounding skin. However, the growth was definitely hard and solid, and gave the impression of being slightly fixed to the underlying tissue.

On October 5, 1937, the tumor with about 1 cm. of surrounding normal skin was excised. It was found that the growth involved the skin and subcutaneous fat down to but not involving the underlying infraspinatus muscle. The growth easily peeled off the muscle, leaving the muscle fibers undisrupted and not bleeding. After the mass was removed the skin edges of the wound were slightly undermined to permit approximation without tension. The wound was closed, obliterating the dead space, and the skin edges brought together with three interrupted silk sutures.

The gross appearance of the tumor gave the impression of malignancy. It was solid, the cut surface gray in color with greasy, granular appearance. There was no evidence of capsulation, but rather an indefinite demarcation from the surrounding subcutaneous tissue. The growth seemed to fade irregularly into the surrounding fat.

Four days after excision the wound broke down, and a small amount of fatty, serous exudate stained the dressings. The sutures by this time were loose, and were removed, leaving the wound somewhat gaping. Although the wound was not infected, the tissue did not seem healthy, being gray in color and bathed in a small amount of greasy exudate. The wound was redressed daily with dry sterile dressings, and in about fifteen days it had filled in and closed over, leaving a small scar. About three weeks after the wound had healed there gradually appeared six small nodules, each the size of a BB shot, one at each stitch mark. These nodules were hard, slightly elevated, and of the same grayish yellow color as the original tumor just before its excision.

On November 11, 1937, a 10 mg. plaque of radium was applied over the site of the operation, covering most of the nodules, and was left in place for three and one-half hours. Due to the size of the radium plaque used all the nodules could not be covered. For the following two weeks the treated area was erythematous, and as the erythema subsided the nodules which had been exposed to the radium gradually disappeared, leaving the skin soft, pliable and of normal appearance.

It is now more than nine months since the radium was used and there is no evidence of a recurrence. The nodules that were not treated have remained about the same size. These were likewise treated with radium.*

Sections of the tumor were sent to some of the better-known pathologists of the country. Two were in accord as to diagnosis; the others all had different interpretations. The acting laboratory director of the Methodist Hospital, Dr. B. M. Edlavitch, reported the tissue as being a sarcoma, the exact type of which he could not differentiate. A pathologist of a large private laboratory diagnosed the tissue as "endothelial sarcoma, probably from skin or blood vessel." Another, a pathologist to a midwestern state medical university, stated that the neoplasm showed definite evidence of malignancy. Because he had never seen one like it, he said he could not positively differentiate it, but he was of the opinion that it was a fibroblastic sarcoma. Another pathologist stated that it was a relatively rare tumor composed of embryonic fat cells, numerous regular mitotic figures and large masses of eosinophiles. He diagnosed the tumor as a lipoblastoma, relatively benign, and added that it was not radiosensitive and would not be affected by radiation.

Another report, from a very noted pathologist of one of the largest clinics in the country read "Very malignant and may be secondary to a renal or adrenal tumor." The late Dr. Jaffe had reported the tissue to be benign xanthoma and had state thatd although there were numerous mitotic figures they were all regular and there was no tendency toward any malignant changes. He advised against the use of radium or *x*-ray as a therapy in this case.

Dr. James Ewing stated, "The tumor of the skin in a newborn infant we think is an embryonal liposarcoma. We seem to have one other case of congenital liposarcoma, but I do not remember the outcome. Your tumor looks to me quite malignant and you seem to have recurrences, which I think should be treated with radiation because this tumor ought to be radiosensitive." And he further stated "the

* More than two years since the tumor was excised and the radium was used, there is no recurrence. The nodules have completely disappeared and the skin appears normal except for the scar.

section of tumor has the structure of a diffusely growing, fully malignant, large round and polyhedral cell liposarcoma. The cells grow diffusely, infiltrating fat tissue, and they are generally finely granular and contain many fine fat droplets. The nuclei are large and quite hyperchromatic. I should say that the grade of malignancy is very high, at least 3."

Dr. Stanley P. Reiman gave us the following report on a piece of the tumor tissue submitted to him: "It is a malignant tumor, most of the cells of which are indifferent in appearance and hence probably undifferentiated physiologically. There is fat in the section. In trying to decide whether this fat was merely invaded or a product of the tumor cells, I reached the conclusion that the latter is the case. My diagnosis is therefore liposarcoma."

This variance of opinions brings out the point that because the cells of an embryonal tumor are quite undifferentiated and usually rapidly growing it is often very difficult to state with certainty, by merely examining a tissue slide, whether the growth is malignant or benign. However, the fact that a recurrence of the tumor occurred would favor the majority of the reports that this tumor was malignant. The tumor did respond favorably to radium, although some of the pathologists considered that it would not. It is not possible always to prognosticate merely from a tissue slide the radiosensitivity of a given growth.

SUMMARY

1. Congenital malignant tumor of the skin in the newborn is very rare.

2. A case of congenital malignant tumor of the skin in the newborn is reported in which excision of the tumor, followed by radium therapy, gave a good result.

REFERENCES

1. Ritter. Angeborenes Carcinom der Haut. *Arch. f. klin. Chir.*, 5: 338–341, 1864.
2. Korte. *Beitr. z. klin. Chir. und Beitr. z. Geburtsh. u. Gynäk.*, 90, 1870.
3. Bedford, G. V. A case of carcinoma of the thymus with extensive metastases in a new-born child. *Canad. M. A. J.*, 23: 197–202, 1930.
4. Anziloti, A. Lesione cancerosa del labbro, trattata con la roentgenterapia in una bambina di due mesi. *Quaderni radiol.*, 4: 22–27, 1933.
5. Pearl, R., and Bacon, A. L. Biometrical in pathology v. The racial and age incidence of cancer and other malignant tumors. *Arch. Path. & Lab. Med.*, 3: 963, 1927.
6. Teri, M. Adatok a csecsemokori veleszulettet, rosezindulatu daganatokhoz. *Budapesti orvosi ujsag.*, 33: 857, 1935.
7. Dudits, A., and Szabo, B. Kongenitales Melanokarzinom des Oberkiefers. *Monatschr. f. Kinderh.*, 63: 294, 1935–1936.
8. Lain, E. S. Congenital cancer, case report. *M. J. & Rec.*, 127: 377, 1928.
9. Colloridi, F. Contributo alla conoscenza de tumori congeniti del lolo nel neonato. *Ann di ost. e ginec.*, 55: 387–424 (March 31) 1933.
10. Canavan, M. M., and Hemsath, F. A. Glioma in the fourth ventricle of a prematurely born infant. *Arch Neurol. & Psychiat.*, 26: 1234, 1931.
11. Frank, W. L., Enfield, C. D., and Miller, A. J. Carcinoma of the tongue in a newborn child; report of a case. *Am. J. Cancer*, vol. 26, 1936.
12. Philipp, P. W. On carcinomas in childhood. *Ztschr. f. Krebsforsch.*, 5: 326, 1907.
13. Rosner, S. La edad en las neoplasias cutaneas. Comentario a una estadistica personal. *Rev. A. Med. Argentina*, 49: 518, 1935.
14. Duzan. Du cancer chez les enfants. Thèse de Paris, 1876.
15. Picot. Les tumeurs malignes des enfants. *Rev. méd. de la suisse. romanche*, 1883.
16. Dean, A. L., Jr., and Pack, G. T. Embryonal adenosarcoma of the kidney. *J. A. M. A.*, 98: 10, 1932.
17. Pack, G. T., and LeFevre, R. G. The age and sex distribution and incidence of neoplastic diseases at the Memorial Hospital, New York City. *J. Cancer Research*, 14.
18. Rankin, F. W., and Broders, A. C. Factors influencing prognosis in carcinoma of the rectum. *Surg., Gynec., & Obst.*, 46: 660, 1928.

INTRAPERITONEAL HEMORRHAGE IN ESSENTIAL HYPERTENSION*

CHARLES R. LAFFERTY, M.D. AND BJARNE PEARSON, M.D.

NEW ORLEANS, LOUISIANA

INTRAPERITONEAL hemorrhage due to the spontaneous rupture of a splanchnic vessel is rare. Ducuing and

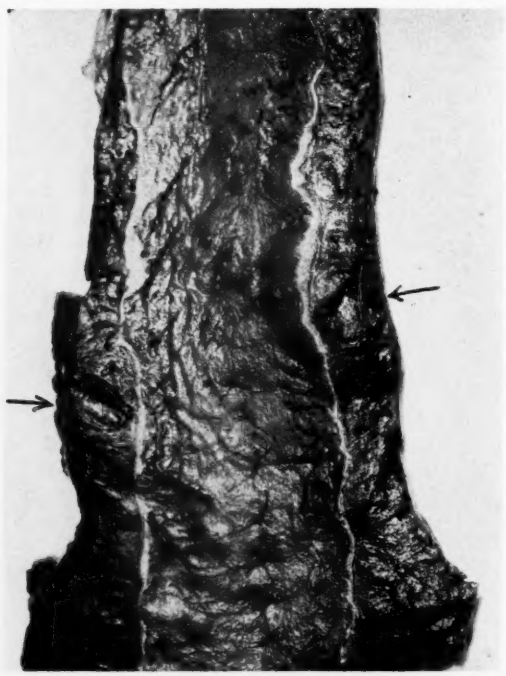


FIG. 1. Ruptured artery with hemorrhage into wall of a segment of transverse colon in a 28 year old colored female.

Florence[1] first described this vascular accident in 1913. In a review of the literature we collected nine additional cases.[2,3,4,5,6,7,8,9] The case herein presented is the eleventh. It is the only case noted in the course of 9,560 necropsies performed during the past ten years at the State Charity Hospital of Louisiana at New Orleans.

CASE REPORT

The patient, a colored female, aged 28 years, was admitted on January 6, 1937 with complaints of shortness of breath, cough and weakness. For the previous month these symptoms had progressed.

She was markedly dyspneic and cyanotic, with a blood pressure of 260/180. Her temperature was 90°F., pulse 120 and respirations 28 per minute. The thorax was symmetrical and moist râles were heard over the base of both lungs. The heart sounds were indistinct and no murmurs were heard. By percussion the heart was found to be moderately enlarged. The abdomen was distended and the presence of fluid noted. The blood Wassermann reaction was strongly positive on two occasions.

Routine treatment for congestive heart failure gave some relief. However, on January 9 the patient suddenly became very dyspneic, her skin was cold and moist and her blood pressure fell to 98/60. She failed to respond to stimulants, became comatose and expired six hours later.

Necropsy. The body was that of a well developed and nourished colored female, measuring 168 cm. and weighing approximately 130 pounds. The peritoneal cavity contained 800 c.c. of liquid and clotted blood. The omentum was markedly hemorrhagic and thickened and it hung freely from the transverse colon. The entire transverse colon was distended and of a dark reddish color. A partially organized blood clot was found in the midportion of the transverse colon at its junction with the mesentery. Further inspection of this area revealed a rupture of a branch of the middle colic artery at its entrance into the colon. This was responsible for the hemorrhage in the peritoneal cavity, mesentery, omentum and wall of the transverse colon. The lumen of the colon contained no free blood. The mucosa was intact throughout and there was no evidence of ulceration. The wall of the transverse colon was a dark red color due to the extravasation of blood into it and measured from 2 to 3 cm. in thickness.

The pericardial sac was moderately enlarged and the heart weighed 400 Gm. The epicardium was smooth and glistening. Cut surfaces of the heart showed marked hypertrophy of the myocardium of the left ventricle. The right auricle and ventricle were essentially negative, the endocardium smooth and intact, the valve edges free. The coronary arteries were

* From the Departments of Pathology and Bacteriology, State Charity Hospital of Louisiana and the School of Medicine, Louisiana State University, New Orleans.

patent throughout. The thoracic aorta showed longitudinal wrinkling throughout the ascending and descending portions.

The right kidney weighed 130 Gm., the left 135. The capsule was stripped with slight difficulty, revealing a dark red finely granular surface with a few scattered petechial hemorrhages. The cut surfaces of the kidneys showed the cortex to be slightly narrowed.

DISCUSSION

The association of rupture of a splanchnic artery with hypertension is rather definite, since in seven of the eleven cases reported there was high blood pressure. In the six cases in which the condition of the artery was mentioned all showed marked arteriosclerosis. In the second case of Moorehead and McLester in addition to the arteriosclerosis and rupture, the various coats of the superior mesenteric artery were separated for a distance of several centimeters by a dissecting hemorrhage. In a series of hypertensive cases Bell[10] found 15 per cent with cerebral hemorrhage. In a series of 497 cases of hypertension from the postmortem records of the Charity Hospital of the State of Louisiana at New Orleans, Decherd and Schenken[11] found that 17.7 per cent had cerebral hemorrhage.

CHART I

REPORTED CASES OF RUPTURE OF SPLANCHNIC VESSELS

No.	Author	Year	Age Sex	Complaint	Site	Blood Pressure	Arteriosclerosis of Ruptured Vessel	Operation	Result	Autopsy
1	Ducuing and Florence	1913	Young woman	Abdominal pain, 8 months pregnant, in labor.	Branch of superior mesenteric artery.	?	?	.....	Died	Yes
2	Starcke	1923	M—60	Severe epigastric pain.	Gastroduodenal artery.	155 systolic two years.	Marked	Ligation	Recovered	
3	Budde	1925	M—27	Severe abdominal pain.	Left gastroepiploic artery.	?	?	Ligation	Recovered	
4	Green and Powers	1931	F—54	Severe abdominal pain.	Left gastric artery.	6 months before operation 270 systolic, 8 months after operation 260/145	Marked	Ligation	Recovered	
5	Mourque-Molines, Cabenac	1933	M—56	Vomiting, gastric upset.	Left gastric artery.	Severe.	Marked	Ligation	Recovered	
6	Thompson, Dunphy	1935	F—62	Precordial pain shock.	Branch of left gastric artery.	Marked hypertension for 6 years. Blood pressure 170/100 two weeks before admission.	Marked	?	Recovered	
7	Buchbinder and Green	1935	M—57	Severe abdominal pain.	Right gastric artery.	Ten days after operation 190/115.	Marked	Ligation	Recovered	
8	Moorehead and McLester	1936	M—44	.....	Junction of right and left gastric arteries.	High blood pressure for several years.	.....	.....	Died	Yes
9	Moorehead and McLester	1936	M—50	Dyspnea.	Superior mesenteric artery.	220/140. Patient treated in ward for hypertension. 280/160.	Marked	.....	Died	Yes
10	Lafferty and Pearson	1938	F—28	Shock, dyspnea.	Superior mesenteric artery.	.....	.....	.....	Died	Yes
11	Morton	1938	M—72	.....	Branch of superior mesenteric artery.	.....	.....	Not ligated	Recovered	

Histologic examination of the lungs, heart, muscles, pancreas, spleen and liver showed nothing of note. The kidneys revealed thickening and hyalinization of the afferent arterioles, with occasional hyalinization of the glomerular tufts. The picture was consistent with renal arteriosclerosis of moderate degree. The aorta showed perivascular round cell infiltration and endarteritis in the vasa vasorum. The middle colic artery showed no apparent pathology. Sections taken through the transverse colon showed marked hemorrhage into the entire wall.

It is possible that the rarity of this vascular accident is associated with the infrequency of arteriosclerotic changes in the vessels of the gastrointestinal tract. Thus Brooks,[12] in a study of 368 cases of arteriosclerosis, found in only nine macroscopic evidence which involved the celiac axis and its branches. Only four cases of arteriosclerosis involving the mesenteric arteries were encountered in his series. Kummel,[13] in a study of the superior mesenteric artery in thirty-nine individuals over 40 years of age, found medial calcification in only one.

In five of the cases reported the rupture occurred in the right or left gastric artery. In addition to the hemoperitoneum, a characteristic hematoma was present in the gastrohepatic omentum. In Starcke's case the rupture occurred in the gastroduodenal artery and in the case of Budde the left gastroepiploic artery. Thus in seven of the ten cases the rupture occurred in arteries emanating from the celiac plexus. In only four cases was the superior mesenteric artery involved (Ducuing and Florence; Moorehead and McLester's second case; Morton; and the case herein presented). In the first case reported in the literature there was no record of the blood pressure or condition of the artery.

Six of the cases occurred in males and four in females. The youngest patient was that of Budde 27 years of age, the oldest that of Morton, 72. The peak of the incidence is in the fifth decade.

In the majority of the cases the chief clinical symptoms were acute abdominal pain in the region of the epigastrium, associated with rigidity of the abdominal muscles and varying degrees of shock. Seven of the patients were operated on and all recovered. The remaining four patients were examined after death.

SUMMARY

Our case represents the eleventh example of intra-abdominal hemorrhage due to the rupture of a splanchnic artery. Most of the cases occur in the right or the left gastric artery. One occurred in the gastroduodenal and one in the left gastroepiploic artery. Only four cases of the superior mesenteric artery have been noted, including the present case. The association with severe hypertension is rather striking as it occurred in seven of the eleven cases. Six cases showed definite marked arteriosclerosis of the rupture vessel. We feel that hypertension, severe gastrointestinal vascular sclerosis, separately or in combination, are decided factors in the precipitation of rupture of the vessel, comparable to cerebral hemorrhage in hypertension. The infrequency of this accident is probably in part due to the infrequent findings of vascular sclerosis in the intestinal arteries. The clinical symptoms are severe abdominal pain associated with varying degrees of shock. All the patients operated on recovered completely.

REFERENCES

1. Ducuing, M., and Florence, M. Contusion du rein. Hémopéritoine. Guérison spontanée. Valeur diagnostique de la ponction exploratrice du cul-de-sac de Douglas. *Bull. et mém. Soc. de chir. de Paris*, 39: 645, 1913.
2. Starcke, G. Spontaneous rupture of gastroduodenal artery. *Ugeskr f. Laeger.*, 85: 963–964 (Dec. 27) 1912.
3. Budde, M. Spontaneous rupture of gastroepiploic artery. *Münchn. med. Wchnschr.*, 72: 1383–1384 (Aug. 14) 1925.
4. Green, W. T., and Powers, J. H. Intra-abdominal apoplexy. *Ann. Surg.*, 93: 1070–1074, 1931.
5. Morque-Molines, E., and Cabenac, E. Abondante hémorrhagie intra-péritonéale par infarctus de l'épiploon-gastro-hépatique. *Bull. et mém. Soc. nat. de chir.*, 59: 720–727 (May) 1933.
6. Thompson, K. W., and Dunphy, J. E. Intra-abdominal apoplexy. *Ann. Surg.*, 102: 1116–1118 (Dec.) 1935.
7. Buchbinder, J. R., and Green, E. T. Intra-abdominal apoplexy. *J. A. M. A.*, 105: 874–875 (Sept. 14) 1935.
8. Moorehead, M. T., and McLester, J. S. Abdominal apoplexy. *J. A. M. A.*, 106: 373–374 (Feb. 1) 1936.
9. Morton, C. B. *Arch. Surg.*, 36: 723–728 (May) 1938.
10. Bell, E. T. Textbook of Pathology. Philadelphia, 1938. Lea and Febiger.
11. Decherd, G. Jr., and Schenken, J. R. Unpublished data.
12. Brooks, H. A preliminary study of visceral arteriosclerosis. *Am. J. M. Soc.*, 131: 778, 1906.
13. Kummel, R. Ueber die sklerose der Eingeweidearterien der Bauchhöhle. *Zentralbl. f. allg. Path. u. path. Anat.*, 17: 1929, 1906.

OSTEOCHONDRITIS DISSECANS*

REPORT OF CASES INVOLVING ELBOW, ANKLE AND METATARSOPHALANGEAL JOINTS

PAUL A. BRICKEY, M.D., F.A.C.S. AND JOHN B. GROW, M.D.

Major, Medical Corps, U. S. Army;
Chief of Surgical Service, Tripler General Hospital

HONOLULU, T. H.

Captain, Medical Corps, U. S. Army;
Fitzsimmons General Hospital

DENVER, COLORADO

OSTEOCHONDRITIS dissecans involving a joint other than the knee is relatively rare; of the reported cases, those involving the knee joint comprise over 85 per cent.[1] The elbow joint is next in order of frequency but only occasional cases have been reported involving the hip, ankle or metacarpophalangeal joints. In this communication we report a case of the lesion occurring in each of the following: capitellum of the humerus, talus, and head of a metatarsal.

Wagoner and Cohn[2] have defined osteochondritis dissecans as "a noninfectious process involving the articular cartilage and the subchondral bone of certain long bones of the extremities, which, by, sequestration from the articular surface, usually produces a single foreign body, or, more rarely, two, in the contiguous joint. This body is originally of an osteocartilaginous composition, but its structure subsequently undergoes alteration by the fluid of the joints." The cause of the lesion is unknown. The relationship of the etiology to trauma has evoked considerable discussion and numerous theories of causation have been evolved. The balance of evidence is in favor of a traumatic causation but the mechanism of the detachment of the loose fragment has not been demonstrated. It is noted that trauma had an important part in the development of this lesion in the following cases.

CASE 1. H. G. B., a white soldier of 28 years, was admitted to the hospital on December 20, 1937 with complaints of pain and tenderness over the lateral aspect of the right elbow and inability completely to extend the joint. He was a baseball pitcher of his organization team and for twenty-three months prior to hospitalization had recurrent attacks of pain and stiffness of the right elbow. On September 26, 1937, while throwing a baseball, he heard a snap in the elbow followed by considerable pain and tenderness over the lateral aspect of the joint and inability to extend the forearm.

Examination. He was a well developed and well proportioned adult male without evidence of endocrine disturbance. There was moderate tenderness over the entire extensor and lateral aspects of the right elbow. Extension of the joint was limited to 135 degrees. Roentgenographic examination revealed a loose body in the right elbow joint and a defect in the capitellum of the humerus. The blood Wassermann test was negative.

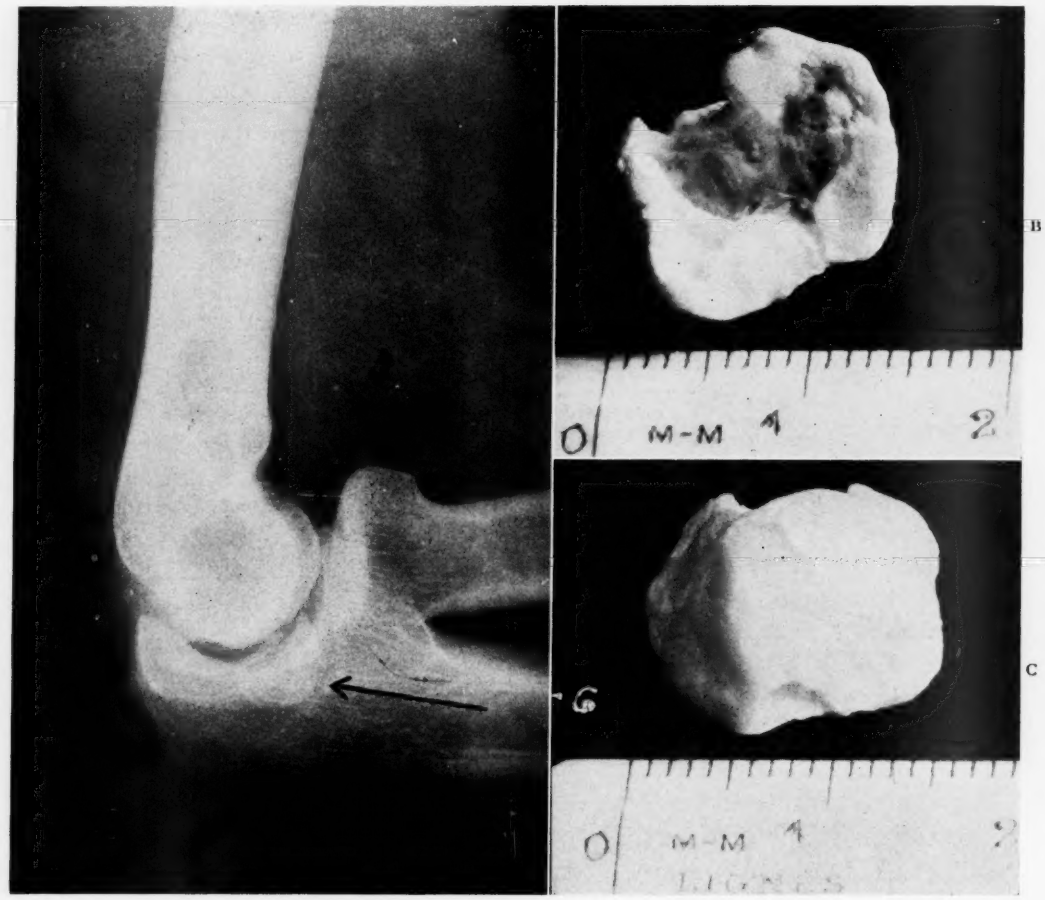
Treatment. An arthrotomy was done December 22, 1937 at which time a body lying entirely loose in the joint was removed (Fig. 1), and the cavity in the capitellum of the humerus from which the body was derived was curetted. The operative wound healed by primary intention. On January 6, 1938 physiotherapy was started with whirlpool, massage and active exercise. Recovery was rapid with prompt return of full range of motion and excellent function of the joint. On January 23, 1938 he was discharged from the hospital and returned to full military duty. He has remained free from symptoms referable to the elbow since discharge from the hospital.

Comment. Miller[3] reported a case of osteochondritis dissecans of the capitellum of the right humerus occurring in a newsboy. He attributed the lesion to the trauma incident to the throwing of newspapers while the boy was working on his news-

* From the Surgical Service, Tripler General Hospital. Published with the permission of the Surgeon General, U. S. Army.

paper route. The mechanism of the production of the lesions in these two cases was the same and they increase the evidence that

swollen and there was marked tenderness over the medial aspect of the joint. Flexion of the foot on the leg caused severe pain in the ankle.



A

FIG. 1. Case I. A, roentgenogram showing body lying free in elbow joint. B and C, views of loose body following its removal from the joint.

osteochondritis dissecans may be caused by slight repeated trauma.

CASE II. M. W. H., a white soldier of 22 years, was admitted to the hospital on August 9, 1937 with complaints of pain in the right ankle on weight bearing, which was most marked on flexing the joint. On July 2, 1937 this man was struck on the medial aspect of his right ankle by a rolling 50 gallon drum of oil which sharply inverted his foot. This injury was followed by the symptoms given above which persisted without significant change in severity to the time of admission.

Examination. This man was well developed and well proportioned. There was no evidence of endocrine disturbance. The patient was unable to bear weight on right foot because of pain in the ankle. The ankle was moderately

Roentgenographic examination (Fig. 2) revealed a partially detached body and an excavation on the superior surface of the talus. The blood Wassermann test was negative.

Treatment. The right ankle was immobilized by a plaster cast on August 10, 1937. The cast was removed on September 13, 1937. Roentgenographic examination at this time showed no change in the lesion. Physical findings were essentially the same as on admission except for the disappearance of the swelling about the joint. An arthrotomy was done on September 24, 1937. A partially separated body approximately 1.5 cm. in diameter was found. This was held in place by a broad area of intact articular cartilage. This attachment was incised and the excavated area of the talus curetted. Physiotherapy and partial weight bearing were started October 20, 1937. The patient made a satis-

factory recovery and function of right ankle was excellent with the exception of slight tenderness on marked flexion which persisted for several months following discharge from the hospital. On December 5, 1937 he was discharged from the hospital and returned to full military duty part of which consisted of infantry drill. This he was able to perform without difficulty.

Comment. This case was seen early in the course of development of the lesion and prior to the detachment of the body from its bed. Immobilization for the joint by a plaster cast was entirely without benefit in a case in which the body was only partially separated; if at all indicated, this is the type of case in which this type of treatment would be expected to show beneficial results. This experience gives further evidence that the treatment of osteochondritis dissecans is surgical irrespective of the stage of development of the lesion.

Case III. G. W., a white soldier of 56 years, was admitted to the hospital on February 24, 1938 complaining of painful corns on the third toe, left foot. In 1918 this man dropped a projectile on his left foot. Following this injury the third toe of this foot developed the shape of a hammer toe. Except for a short period immediately following the injury there had been no pain on movement of the toe and no difficulty in walking. However, because of the shape of the toe, the rubbing of a shoe caused painful corns to form on the dorsum of the toe and on the neighboring toes. He came to the hospital requesting relief during a period when his corns were particularly painful.

Examination. He was a well developed, obese, adult white male. Obesity was present, but was not believed to be due to endocrine disturbance. He had a persistent arterial hypertension of approximately 230 systolic and 130 diastolic measured in millimeters of mercury. Retinal examination revealed an arteriolar sclerosis. Physical, roentgenographic and electrocardiographic examination of the heart revealed findings compatible with a diagnosis of hypertensive heart disease of an essential type. Blood chemistry and urine examinations were within normal limits. All toes of both feet were normal in appearance with the exception of the third toe, left foot, which was a hammer toe. On the dorsal, lateral and medial aspects of the proximal interphalangeal joint of this toe were large tender corns. The blood Wassermann test was negative.

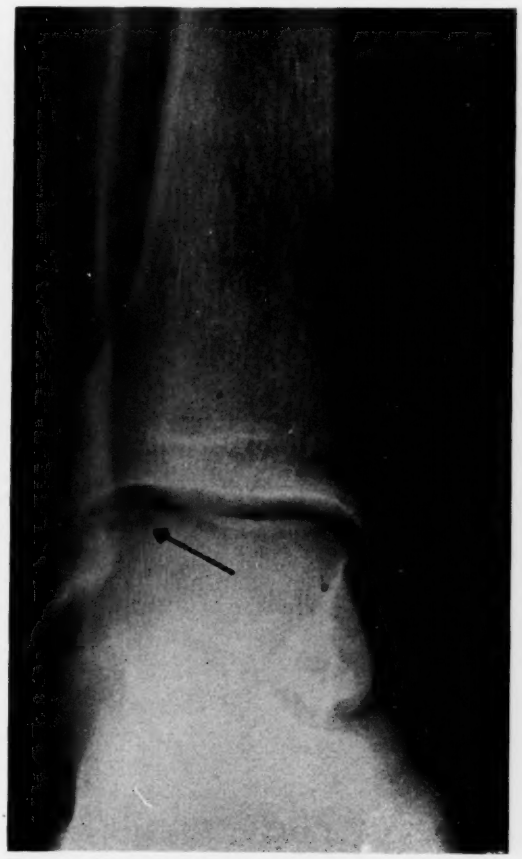


Fig. 2. Case II. Roentgenogram of right ankle showing osteochondritis dissecans involving the superior articular surface of the right talus.

Treatment. The third toe, left, was disarticulated at the metatarsophalangeal joint on February 25, 1938. The articular surface of the base of the proximal phalanx was found to be quite misshapen, the articular cartilage of the head of the metatarsal and a calcified loose body were lying loose within the joint. (Fig. 3.) A roentgenogram taken following the operation shows the condition of the head of the metatarsal. (Fig. 3.) There was delayed healing of the operative wound due to a low grade infection of the proximal angle of the wound, but it was well healed by March 15, 1938. On April 4, 1938, he was returned to full military duty which he has performed without difficulty since that time.

Comment. This case is instructive in that there was a traumatic derangement of a metatarsophalangeal joint severe enough to produce a hammer toe of twenty years' duration. This resulted in no disability other than that incident to painful corns the result of pressure of a shoe on the deformed toe although this man's duties required extensive use of his feet.

A B

FIG. 3. Case III. A, third toe of left foot following disarticulation at the metatarsophalangeal joint and two loose bodies which were found within the joint space. B, roentgenogram of foot taken following removal of the toe. Note deformity of head of third metatarsal resulting from osteochondritis dissecans of twenty years' duration.

SUMMARY

1. Three cases of osteochondritis dissecans are reported occurring in joints other than the knee, i.e., elbow, ankle, and metatarsophalangeal joints.

2. The lesion may be produced by traumata varying widely in type and intensity from a single, severe crushing injury to a mild, repeated injury resulting from the forces brought into play by joint movements.

3. The treatment is the surgical removal of the detached fragment.

REFERENCES

1. CONWAY, F. M. Osteochondritis dissecans. *Am. J. Surg.*, 38: 691, 1937.
2. WAGONER, G., and COHN, B. N. Osteochondritis dissecans. *Arch. Surg.*, 23: 1, 1931.
3. MILLER, L. F. Osteochondritis of the capitellum of humerus. *Radiology*, 27: 237, 1936.

PRIMARY CARCINOMA OF THE FALLOPIAN TUBES*

WILLIAM D. FULLERTON, M.D., F.A.C.S.

Visiting Gynecologist, University Hospital

CLEVELAND, OHIO

PRIMARY tumors of the fallopian tubes are among the rarest of new growths. This is difficult of explanation in view of the great frequency of such growths in the other female pelvic organs.

Tubal tumors are well classified by Watkins[1] into those arising from epithelial cells, connective tissue, or from embryonal cell rests. The primary tumors originating from epithelial tissue include carcinoma, endometrioma, adenoma, papilloma, endothelioma, cysts, and chorionepithelioma; from connective tissue, fibroma, lymphangioma, lipoma, and sarcoma; from embryonic cells, dermoids and teratoma. Among these tumors carcinomata are the most common.

Some idea of the rarity of fallopian cell carcinoma is shown by the fact that Vest[2] found only four cases in 19,000 gynecological admissions to the Hopkins Hospital, and Barrows,[3] three cases in 30,000 such admissions at Bellevue Hospital. Holland[4] reported nine cases in 10,000 complete salpingectomies from the Mayo Clinic. At the University Hospitals, Cleveland, we find but two cases in 22,300 strictly gynecological admissions, not including 62,000 general surgical admissions, at least one-sixth of which were for pelvic diseases in women; in all, a general average of about one case in 10,000 gynecological admissions, or one primary carcinoma in every 1,000 salpingectomies.

The condition was first described macroscopically by Renaud[5] in 1847. Orthman,[6] in 1886, gave the first accurate description and pathology of the condition. In 1910 Doran[7] tabulated 100 cases, and in 1925 Bower and Clark,[8] in an excellent paper, reviewed 133 cases. In 1929 Wharton and Krock[9] brought the subject up to date with a collection of 244 cases. Since then, occasional reports of one or two cases, by McGlinn and Harrer[10] and others, have brought the total to probably not more than 275 cases at the present time. The condition, though rare, is no doubt often and easily overlooked, being mistaken for an ordinary pelvic inflammatory state. This is yet another reason to urge a most careful gross examination at operation and a complete microscopic examination of all tissues removed surgically. If carcinoma is recognized at operation, a complete hysterectomy is imperative; if not until later, postoperative deep *x*-ray or radium may do much to improve the present poor results.

The etiology is unknown. Many authors have suggested the important influence of a pelvic inflammatory condition, but many afflicted women have never had such a condition. Considering the great frequency of pelvic inflammation, we would expect to see many more cases of tubal carcinoma if the inflammation were a pertinent factor. Tuberculosis of the tube seems to be more frequently coincident than one would expect and may be of importance in stimulating the formation of benign papillomata which subsequently become malignant. Here we must urge greater accuracy in the pathologic diagnosis as we have seen several reproduced photomicrographs of tuberculous salpingitis which have been reported as primary carcinoma. The hypertrophied epithelium and epithelial cells, which due to the manner of section are often seen out in the muscular or connective tissue layers, have been mistaken for malignant cells.

We now not infrequently recognize endometrial implants in the tube, and it

* From the Gynecological and Obstetrical Departments, University Hospitals.

may be possible, as Kelly[11] suggests, that certain tubal carcinomas, especially the adenomatous and medullary types, have their origin in this aberrant tissue.

Primary tubal carcinoma is about equally frequent in parous and non-parous women, so that fertility is not influential. Age does not seem to be significant, and although this carcinoma is most common in the fifth decade, Bower and Clark's patient was 25, Holland reported a case in a woman of 26, Norris[12] in one of 29, Novy[13] 70, and Jacob[14] in one of 73 years. One of the cases we have to report was in a woman 80 years old, the oldest case on record so far as we can learn.

About one-third of all cases are bilateral when recognized. This may be due to independent development or to direct extension through the uterine cavity, transperitoneal migration, or from metastases from the other tube by way of the blood or lymphatic channels. The tube is frequently involved secondarily to carcinoma of the ovary or fundus, as well as occasionally from carcinoma of the cervix, stomach, or gall-bladder. Secondary involvement is ten times as common as a primary growth. If the growth is primary, it usually starts in the tubal mucosa; if secondary, in the wall of the tube or on its peritoneal surface.

The most common primary carcinoma of the tube is papillary in type, the advanced stage of which may be adenomatous in appearance. Both pictures are frequently seen in the same growth. These papillary carcinomas may develop from benign papillomata or arise independently from the tubal mucosa. They occur usually in the outer half of the tube, the fimbriated end of which closes early, though the uterine end does not, and the tumor may be felt as a soft, loose mass through the distended, clubbed, thin-walled, sometimes fluctuant tube. The medullary carcinomas are usually firmer and fibrous, though like the papillary growths they may be cystic. Peritoneal adhesions are not common in early cases and the tube looks like a hydrosalpinx, but is firmer, sausage-shaped, and contains a purulent, sanguinous fluid or grumous mass. The tumors are from 1 to 15 cm. in diameter, depending somewhat upon the duration.

Gross differentiation from benign papillomata is often very difficult. With the benign tumors the fimbriated end of the tube is more often open and the cauliflower-like growth, which is not ulcerated or necrotic, may protrude. Benign growths show no local or distal signs of invasion.

Microscopically the benign tumors show usually but a single layer of epithelial cells covering the villi or lining the gland-like spaces formed by adherence or coalescence of the villi. The epithelial cells are uniform in size and shape, as are their nuclei, and all stain uniformly. Nuclear figures and cellular division are rare and there is no evidence of cellular penetration or invasion of the underlying structures.

If the growth is malignant, the epithelial cells are in most cases several layers deep, irregular in size and shape, with irregularly staining large nuclei. A marked vacuolization of the cells and nuclei is often seen. Mitoses are common. Invasion of the tube wall is relatively late or may be absent. The sub-epithelial connective tissue shows round cell infiltration. The tubal epithelium is normal except where involved. When adenomatous in appearance, the picture is not unlike adenocarcinoma of the fundus. Endometrioma, tuberculosis, and chronic inflammation of the tubal wall are to be carefully differentiated, especially from the medullary type of carcinoma.

The peritoneum, ovary or fundus may be involved through metastases or by direct extension. Implantation on the endometrium is very rare. Distant metastases and glandular involvement occur early and are seen in one-third of all cases. The superior lumbar, inguinal, external iliac, hypogastric and sacral lymphatics being most often affected.

Meigs[15] states that in 396 cases of carcinoma of the cervix, there were metastases to the tube in six, 1.5 per cent;

in 122 carcinomas of the fundus, three, or 2.5 per cent showed the tube involved; and in 131 carcinomas of the ovary, the tube showed metastases in six, or 4.5 per cent. He emphasized the difficulty, due to the similarity in microscopic appearance, in differentiating between primary and secondary growth in the tube when the fundus or ovary is also involved. The growth may simulate a squamous carcinoma and be the result of metaplasia of the tubal epithelium or a direct extension from the cervix.

There are no distinctive symptoms. More often than not there is some slight disturbance of menstrual function with some increase in frequency and irregularity. Post-menopausal bleeding may occur. A free, clear, or slightly bloody watery discharge, which occurs constantly or intermittently, and often comes in gushes, is suggestive. A foul odor indicates necrosis. Pain referred to the lower abdomen is earlier than with carcinoma of the cervix or fundus, and is probably due to stretching and muscular activity of the tubal wall, as with an ectopic pregnancy.

With any of the above symptoms, the finding of a normal cervix, fundus and ovaries, and the presence of a soft, unilateral mass, should make one suspicious, especially if there be some blood-stained free fluid in the abdomen. Very rarely may minute fragments of cancer tissue be found in the watery discharge from the vagina. This should be collected, filtered, and any sediment examined microscopically. If, as in one of our cases, diagnostic curettage shows very little tissue, but the presence of carcinoma, especially of a papillary type, the correct diagnosis is probable.

If the diagnosis can be made in advance, or is made at operation, the treatment is pan-hysterectomy with removal of both tubes and ovaries. Postoperative deep *x*-ray or radium therapy is always indicated.

Unfortunately the symptoms are not striking. The disease progresses rapidly and most cases are advanced, adherent, and with glandular involvement when first seen. The prognosis is poor, recurrences are common and early, and but few five-year cures are obtained. Bower and Clark[8] reported the mortality in 133 collected cases. In eighty cases in which the operation was incomplete, 56 per cent died. Other organs were involved in forty-three of the forty-five deaths. In fifty-three cases of which twenty-one had local metastases, but in which complete operation was done, the mortality was only 34 per cent. These figures are excellent but misleading as many cures were reported of patients still convalescent. They do show, however, the superiority of the complete operation. Lipschitz[16] reported only four four-year cures in 122 cases, and Graves[17] estimated the five-year cures at not over 4 per cent.

REPORT OF CASES

Case 1. R. G., was admitted to University Hospital, July 7, 1934. She was then 80 years old and had had two children. She complained of slight spotting for the previous four months, at first infrequent, more recently almost constant. There was at times some brownish, malodorous, watery discharge. Occasionally she had some slight cramp-like discomfort in the lower abdomen. For two years she had had a chronic pyelitis and low grade chronic cystitis with occasional dysuria. Menopause had occurred thirty-four years before. A malignant right breast had been removed twenty years previously.

The patient was mentally alert. Physical examination was essentially negative. The urine showed a trace of albumin and a few hyalin casts. Pelvic examination showed a contracted senile vagina and normal cervix. The fundus was small, forward and movable. The right ovary was very small and movable. On the left there was a movable, semi-fluctuant, elongated mass, giving the impression of a hydro- or hematosalpinx.

A diagnostic curettage was done under nitrous oxide anesthesia. The cervical canal was located with much difficulty and was very stenosed and tortuous. When the probe was withdrawn, perhaps 1 ounce of straw-colored fluid escaped, which on examination was found not to be urine. This fluid was filtered and a few recovered shreds of tissue included with the very sparse uterine scrap-

ings. Very fortunately these showed microscopically the presence of a papillary carcinoma. (Fig. 1.)

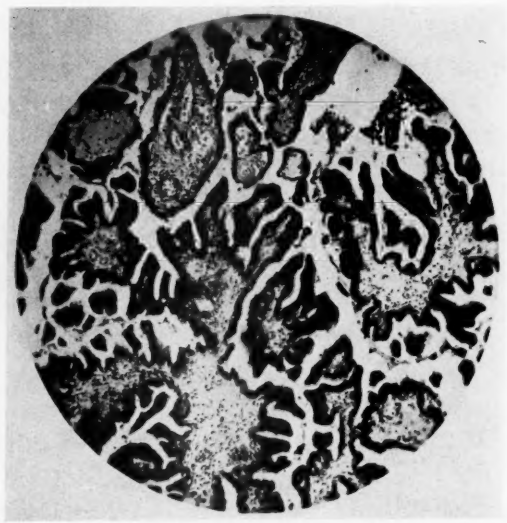


FIG. 1. Papillary adenocarcinomatous tissue from tube, removed from uterine cavity in hydrometrial fluid by diagnostic curettage.

malignant growth of the uterine body. The optional treatment with radium or hysterectomy was given the patient. Considering her age, we advocated radium, but the patient insisted upon operation.

Three days after curettage, laparotomy was done under spinal anesthesia (spinocaine 3 c.c). The uterus was slightly enlarged, the right tube and ovary normal, but both very atrophic. The left tube was smooth and glistening, grayish pink in color, and was distended to about 2 cm. in diameter, approximately 15 cm. long, sausage-shaped, the fimbriated end closed, the wall almost transparent. A soft, movable mass and fluid were palpated in the lumen. The only pelvic adhesion was one very light one from the left tube to the sigmoid. A pan-hysterectomy with bilateral salpingo-oöphorectomy was quickly and easily done.

The patient made a very satisfactory recovery and was discharged on the sixteenth day and remained perfectly well for eight months when she rapidly developed an ascites and

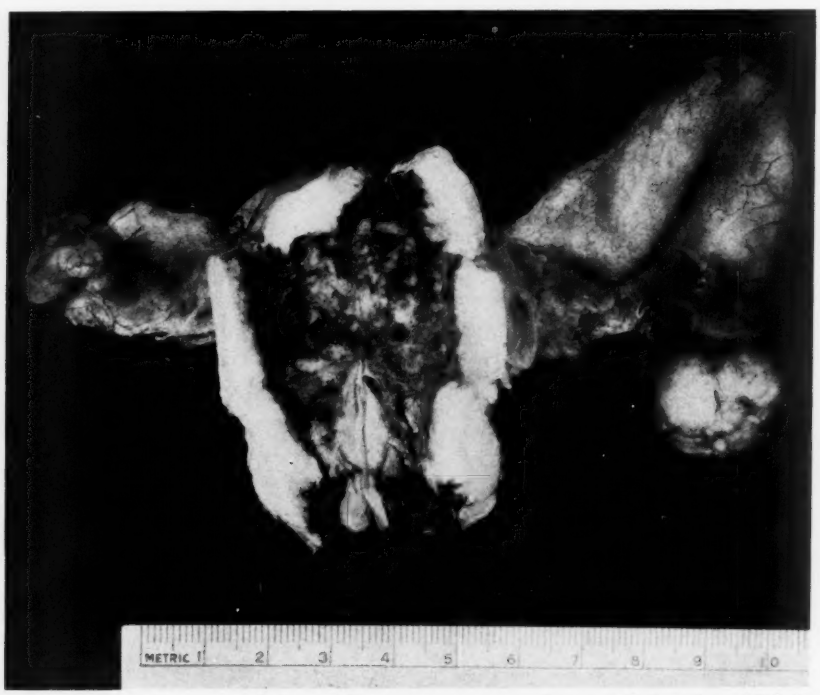


FIG. 2. Gross specimen. Case 1. All structures normal except left tube which is distended by papillary carcinoma within the lumen. Fimbriated and closed.

It was hard to correlate the presence of such a growth in the fundus with the very scanty scrapings, and in the light of our present knowledge would have led to a correct preoperative diagnosis. At the time we felt we were dealing with an unusual type of

nodules deep in the abdominal wall, both of which are undoubtedly due to metastases and indicate an early exitus.

The very careful pathologic examination with serial sections was negative for all tissue except the left tube. This had an average

diameter of 18 mm. and was somewhat club-shaped. Weight of the entire specimen was 30 Gm. (Fig. 2.) Sections through the wall revealed a thin, transluscent tissue, probably the remains of both the serosa and muscularis, and the entire lumen was filled with a grayish pink, friable, granular tissue, which was mottled with pinpoint yellow areas. The lumen was lined by an irregular layer of columnar epithelium from which many small buds and complex papillae arose. Some papillae had a very substantial connective tissue framework (Fig. 3) others almost none. The epithelial covering was most irregular, varying from one to many cell layers thick and in places formed a solid mass of cells with a marked adenomatous appearance. (Fig. 4.) The individual cells and their nuclei varied greatly in size and shape, as well as in staining characteristics. Hyperchromatism was marked. Cell division and nuclear figures were common, and of special interest was the marked vacuolization of many of these cells. (Fig. 5.) Primary adenopapillary carcinoma of the left tube was the final diagnosis.

Fig. 3. Large papilla with small base from tube wall at A. Note large amount of connective tissue and variation in thickness of epithelial covering.

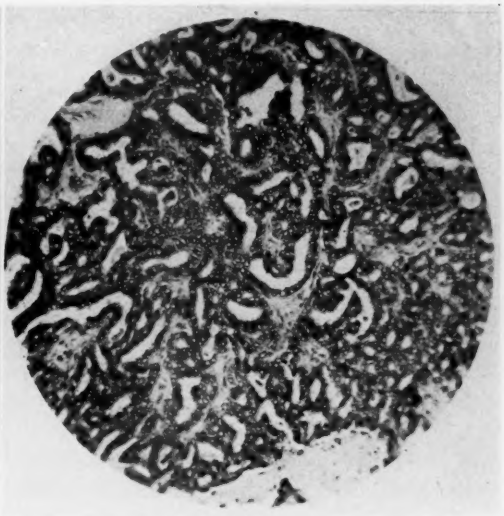


Fig. 4. Marked adenomatous appearance occasioned by coalescence of papillae. Note sparsity of connective tissue and vacuolization of epithelial cells.

Fig. 5. Gland-like spaces lined by epithelial cells which are irregular in size and shape. Cells and nuclei vary in staining density. Mitoses and cell division common. Marked vacuolization in cells.

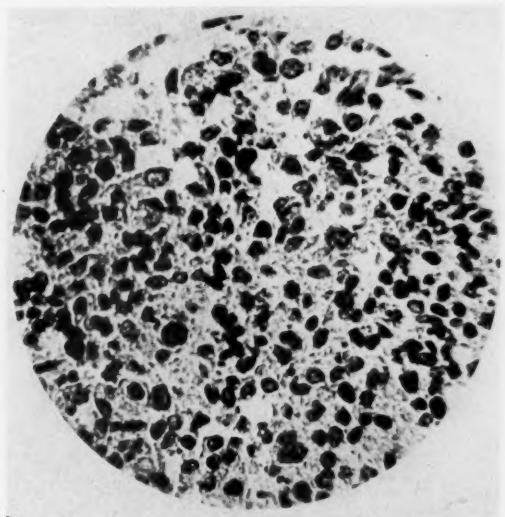


Fig. 6. Section from tube. Case II. Malignant cells with very little stroma. Irregularity in size and shape of nuclei which are hyperchromatic. Vacuolization and nuclear figures seen.

Case II. J. J., was admitted April 20, 1934. She was 52, para i, had had three miscarriages.

Menopause had occurred three years previously and no vaginal bleeding had been noted since. She complained of an abdominal enlargement noted for the past three months; radiating pains down the legs; difficulty in starting urination; and a one-year's increase in weight from 117 to 146 pounds.

Physical examination showed a distended abdomen with free fluid present. A firm, irregular mass was felt in the midline of the lower abdomen extending to the umbilicus. The cervix was normal, the uterus could not be made out separate from the mass which filled the pelvis and was fixed. The urine contained a moderate trace of albumin and a few casts. Wassermann was negative as were *x*-rays of the chest.

Exploratory laparotomy was done under local anesthesia. Nine quarts of straw-colored fluid were evacuated. The omentum was adherent to the parietal peritoneum and to the pelvic structures which were inseparably matted together. The aortic and mesenteric lymph glands were enlarged and the liver contained metastases. A mesenteric gland was removed for biopsy and the abdomen closed. The patient died one month later. Autopsy showed metastases to the lungs, abdominal lymphatics, liver, peritoneum, and both ovaries, neither of which was enlarged or cystic. The stomach, gall-bladder and intestines were normal. Both tubes were enlarged, thickened and closed.

Sections of the tubes showed some few areas of normal tubal mucosa, but mostly tumor tissue which filled the lumen and had deeply infiltrated the musculature. The growth was composed of large, polyhedreal epithelial cells varying in size as did their nuclei, which were vesicular and irregular in staining. Many dividing cells and nuclear figures were seen. (Fig. 6.) In some areas there was a suggestion of gland formation. The tube was considered the origin of the primary tumor, but it was impossible to say whether primary in one tube or bilateral. All metastases were similar in cell structures to the tubal tumor. Primary carcinoma simplex of the fallopian tube with metastases was the ultimate diagnosis.

SUMMARY

1. Primary carcinoma of the fallopian tube, though rare, is undoubtedly often overlooked. It occurs about once in every 10,000 gynecological cases. Many reported cases have apparently been incorrectly diagnosed.

2. Symptoms and signs are not specific. The cervix is normal, the fundus not usually pathologic. A soft, semi-fluctuant mass may be felt in the position of the tube. Slight irregularities in menstruation or post-menopausal spotting are common. A slight, continuous or intermittent watery discharge, which often comes in gushes, is suggestive. The finding of papillary carcinomatous tissue in this discharge, or at diagnostic curettage, yielding very little scrapings, is very suggestive evidence.

3. The disease is usually advanced when first seen. Metastases occur early and the end results are very poor, with probably not over 5 per cent five-year cures.

4. Pan-hysterectomy and the removal of both tubes and ovaries is the only treatment worthy of trial. Postoperative deep *x*-ray therapy or radiation should be given.

5. The condition should always be borne in mind and all tissues carefully examined grossly at operation as well as microscopically postoperatively.

REFERENCES

1. Watkins, R. E. Obstetrics and Gynecology, Vol. 2. Philadelphia, 1933. W. B. Saunders.
2. Vest, C. W. *Bull. Johns Hopkins Hosp.*, 25: 305, 1914.
3. Barrows, D. N. *Am. J. Obst. & Gynec.*, 13: 710, 1927.
4. Holland, W. W. *Surg., Gynec. & Obst.*, 51: 683, 1930.
5. Renaud. Quoted by Holland.[4]
6. Orthman. *Zentralbl. f. Gynäk.*, 10: 816, 1886.
7. Doran, A. *J. Obst. & Gynec. Brit. Emp.*, 17: 1, 1910.
8. Bower, J. O., and Clark, J. H. *Arch. Surg.*, 11: 586, 1925.
9. Wharton, L. R., and Krock, F. H. *Arch. Surg.*, 19: 848, 1929.
10. McGlinn, J. A., and Harrer, W. B. *Am. J. Obst. & Gynec.*, 26: 354, 1933.
11. Kelly, H. A. Gynecology. New York, 1928. D. Appleton.
12. Norris, C. C. *Surg., Gynec. & Obst.*, 8: 272, 1909.
13. Novy. *Monatschr. f. Geburtsh. u. Gynäk.*, 11: 1043, 1900.
14. Jacob. In discussion of Norris' paper.[12]
15. Meigs, J. V. Tumors of the Female Pelvic Organs, p. 485. New York, 1934. Macmillan.
16. Lipschitz, K. *Monatschr. f. Geburtsh. u. Gynäk.*, 39: 33, 1914.
17. Graves, W. P. Gynecology, p. 535. Philadelphia, 1928. W. B. Saunders.

NEW INSTRUMENTS

THE BUIE SIGMOIDOSCOPE

AN ALTERATION IN ITS DESIGN TO FACILITATE DIFFICULT EXAMINATIONS

NEWTON D. SMITH, M.D.

Section on Proctology, The Mayo Clinic

ROCHESTER, MINNESOTA

IT is often difficult or impossible to insert the sigmoidoscope, which is 10 inches (25 cm.) long and 5/8 inch (1.8 cm.) in diameter, in those patients who have lesions within the bowel which decrease the normal diameter of the rectum, rectosigmoid or sigmoid, or who have lesions external to the bowel which alter its normal location or distort its normal contour, or in patients in whom the normal mobility of this portion of the bowel is limited. Frequently, in such patients, however, it is possible to introduce a sigmoidoscope which is 10 inches (25 cm.) long but only 7/16 inch (1.2 cm.) in diameter. In treating such patients as these, because of the presence of the abnormality, a thorough examination is imperative in spite of the fact that they are usually weaker and often less coöperative than those in whom the bowel is normal.

The sigmoidoscopic examination is usually attempted primarily with the larger Buie sigmoidoscope, which is easier to introduce through the lumen of the bowel because of the larger field which it exposes to the examiner's view. It has been necessary to withdraw the larger sigmoidoscope and then introduce the smaller one through the same portion of the bowel, a time-consuming and often uncomfortable manipulation.

Recently, with the assistance of Mr. Thorvald Maijgren, two types of Buie sigmoidoscopes have been altered to facilitate the examination of the difficult cases previously mentioned. These alterations have been accomplished in such a manner that the new instruments may be employed regularly by those physicians using the original instruments, without changing the technique they are in the habit of using.

The angle of the auxiliary tube with relation to the main tube has been altered by elevating it externally in order to permit the passage of the smaller instrument through the larger one, and also to provide a projecting metal surface medially to protect the glass tip which closes the distal end of the auxiliary tube. Externally, the distal end of the auxiliary tube presents a rather flat, smooth surface, so slightly elevated above the surface of the sigmoidoscope proper that it will cause no more discomfort while being inserted than did the original instrument. Changes in the smaller instrument have been confined to the proximal end. The disc at the proximal end has been provided with a collar so slotted on either side that it will engage and, with a slight "arrow-indicated" rotation, lock on two pins which project from the external surface of the sigmoidoscope proper. The handle of the obturator of the smaller instrument has been lengthened to allow the distal end of the obturator to be engaged in the lumen in that portion of the bowel examined with the larger instrument, and this engaged position is maintained until the larger sigmoidoscope has been withdrawn 3 or 4 inches, after which the withdrawal of the

larger instrument can be completed with little danger of altering the position of the smaller one. The collar on the light carrier since constant contact with the field will tend to provide a continuous observation, rather than an observation interrupted by

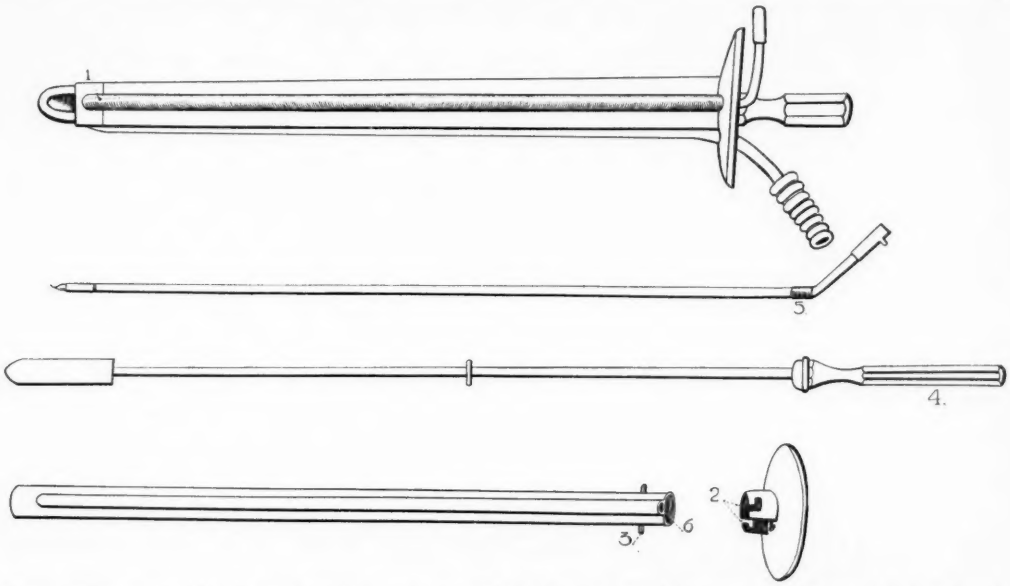


FIG. 1. Illustrates the alterations in two types of the Buie sigmoidoscope as follows: (1) distal end of the auxiliary tube, the entire tube being elevated externally both to protect glass tip at distal end and to permit passage of the smaller instrument through the larger one; (2) collar of the disc on the proximal end, with slots which engage (3) the two pins on the external surface of the sigmoidoscope proper; (4) obturator used in the smaller Buie sigmoidoscope showing how the handle has been lengthened; (5) light carrier of the smaller Buie sigmoidoscope, showing the lengthened collar which serves to prevent motion of the proximal part of the instrument during use; also, alteration in external diameter of collar to provide an airtight joint at the disc.

for the smaller instrument has been lengthened, and its external diameter has been altered sufficiently to permit it to fit snugly into the auxiliary tube, providing an airtight joint. The collar also engages the opening through the disc, preventing undue motion of this portion of the instrument during its use.

As soon as the physician is familiar with the use of the instruments, it seems reasonable to assume that these changes will enable him to examine difficult cases without the unnecessary expenditure of time and without causing unnecessary discomfort. It is also possible that the difficult examination will prove more valuable, the complete removal of one instrument and the reinsertion of another. Two types of the larger sigmoidoscope have been designed: one with a suction tube for removing smoke during fulguration, and the other without suction. All the accessories: inflation bulb, observoscope and magnifying lens, which were designed for the original instruments, can be used in the new instruments.

Undoubtedly, these instruments will facilitate other measures, such as placing radium applications accurately at the proximal end of annular carcinomas in the rectum, rectosigmoid and sigmoid, as suggested by Dr. H. H. Bowing.

THE USE OF A TOOL JIG AND A NEW TYPE OF SCREW IN BONE PLATING*

JOSEPH TENOPYR, M.D., F.A.C.S. AND WILLIAM P. CORRIERO, M.D.

Director of Surgical Service, Kings County Hospital — Assistant Surgeon, Kings County Hospital

BROOKLYN, NEW YORK

THE idea that internal bone fixation by plates or other material can be done only by a well organized group, with many specialized instruments is held in many quarters. This is not always possible, however, because transportation over long distances is not advisable in some cases. It has been the thought of the authors to simplify as much as possible the handling of some of the parts used in this type of work.

We are using a different type of screw. (Fig. 1.) It will be noted that it is a straight non-tapering type of screw without the usual tap end. We use a regular tap for threading the holes in the bone, feeling that there is less chance of the screw becoming loosened. However, the most important change is in the head of the screw. This has not the usual slot for the screw driver, but in its stead a hexagonal hole which is fairly deep. Into this hole fits a perfectly adapted hexagonal driver or wrench. The fit is so close that when the wrench is put into the screw-head the latter will not fall out. This combination of hexagonal hole and wrench has the advantage that once they are engaged there is no slipping out, both moving as one solid unit when being driven into the bone.

There is also the added advantage that loose muscle fibers or fascia cannot become entwined in the slot in the screw nor in the screw driver, since the screw margin in the head is smooth and the wrench action is at the very center of the screw with nothing overhanging the screw edge as in the case of some special screw holders now being used. We have also added a refinement in that the hexagonal wrench is fitted into a "Yankee" type of handle, by means of which up and down strokes on the handle impart a rotary motion in either direction to the wrench.

Another device in simplifying our procedures is a tool "jig" by means of which we are able to accomplish mechanical accuracy in fitting the hole, the taps and the screws to each other. For each size screw used we have a separate "jig," one of which is shown in Figure 2 completely loaded with drills, taps and the new screws already described above. These "jigs" are turned down on a lathe from 3 inch brass solid stock. The base is of the original 3 inch stock and the neck the part turned down on a lathe; the whole comprises a solid unit. The top of the neck has three holes of equal size to hold the drills. In the shelving part of the base are three holes of the same size and threaded to hold the taps. Around the side of the base are eight holes of the same size, threaded to hold eight screws. Each "jig" is loaded previous to sterilization, wrapped in gauze and then sterilized, and is delivered on the surgeon's work table in this fashion. Each "jig" is a complete working unit; the drills will make the exact hole for the right tap, which in turn will make the exact threads for the right screw. These "jigs" can be made in any other form or shape or they may even be combined all in one unit, depending upon the desire of the individual surgeon. The chief idea is that the whole set-up is loaded previous to sterilization (even the day before, or kept always loaded) and the layout is orderly according to size. At a glance all tools and screws can be ac-

* From the Surgical Service, Kings County Hospital.

counted for. For further simplification the hexagonal holes in the screw heads are of the same size for all size screws so that one wrench fits them all.

We have used this set-up on the Surgical Service of the Kings County Hospital and have found that there was a minimum of handling and picking out of small parts of the necessary armamentarium during the operation. The new type of screw seems much easier to handle in the wound than the old type.

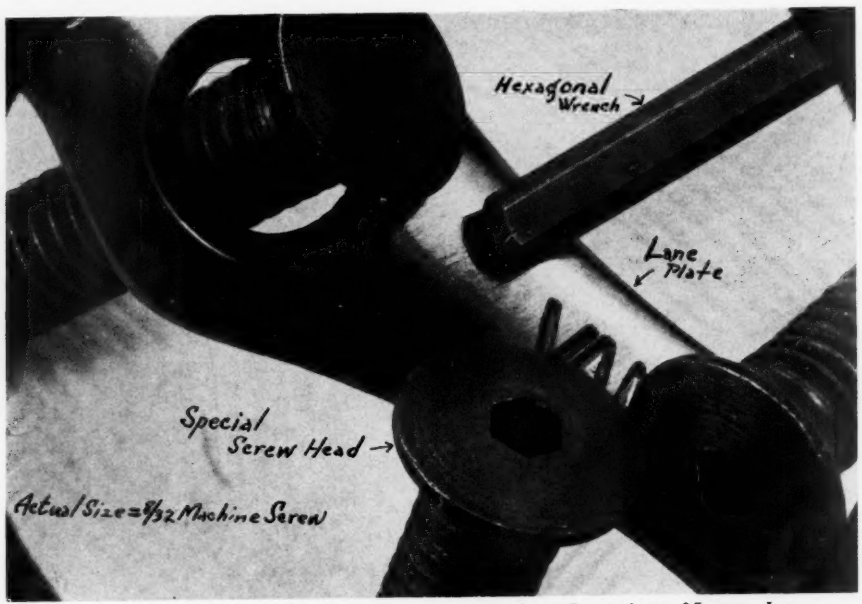


FIG. 1. Detail view of heads of screws, wrench and portion of Lane plate.

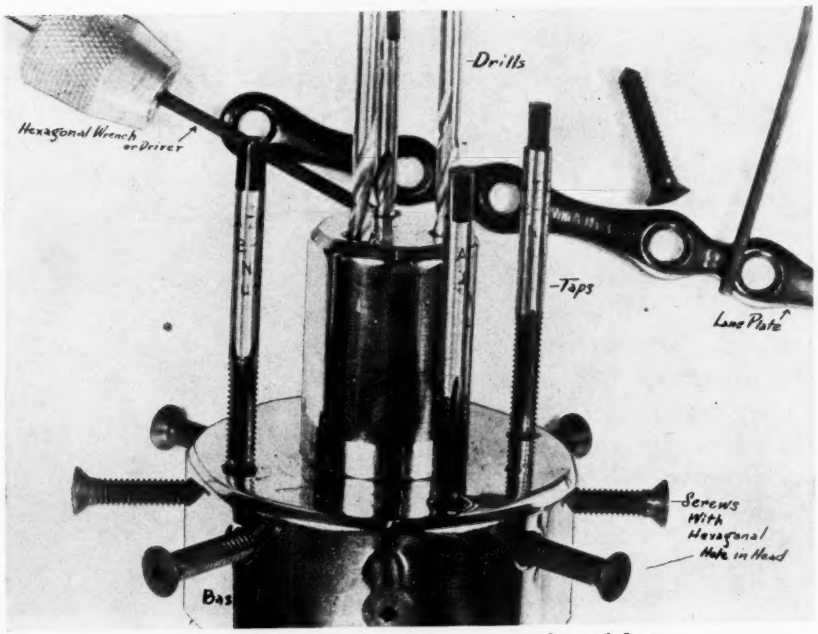


FIG. 2. Tool jig loaded with drills, taps and special screws.

A BUTTON FOR HOLDING TENSION SUTURES

SHERMAN S. PINTO, M.D.

OMAHA, NEBRASKA

TO the layman, the appearance of a scar in the skin is frequently taken as a criterion for the quality of the surgical work which has been done beneath the skin. For this reason it is important that the surgeon secure the neatest appearing scar which is compatible with efficient, rapid work. In surgery of the breast, particularly after radical mastectomy, scars, because of their ugliness, are often a source of annoyance to the patient and of discredit to the surgeon. In this area, as in many others, tension sutures are inserted and drawn so tightly that either normal bodily movements or postoperative edema cause them to cut into the skin. This helps to produce an objectionable scar. Lister[1] realized this and attempted to overcome it by the use of "suture buttons," made of oval pieces of sheet lead. Solid silver wire was used as suture material. A wire was wound around one button, inserted through the skin of the incision from side to side and tension maintained by wrapping the end of the wire around a second button. Interrupted sutures were also used along the skin margins. Undoubtedly the removal of these buttons was painful, and this alone helped to make them unpopular. The older textbooks of surgery—Gerster,[2] Pick[3]—mention Lister's buttons briefly, but their use is not stressed in modern English and American surgical texts. However, some surgeons at the present time are using bone buttons for the same purpose although they are a rather unsatisfactory substitute.

A modified button which we have developed is suitable for use particularly with silkworm gut. It is devoid of sharp angles and is so designed that the tension sutures may be cut and removed with a minimum of discomfort to the patient. The buttons are made of metal and, although light, are strong enough to withstand any pull which might be exerted on them by the sutures. The holes in the buttons are large enough to allow a needle threaded with suture material to be passed through readily and when the suture is tied the button surface against the skin is large enough to allow pressure without necrosis. Figure 1 shows how the buttons are most easily applied. The ends of two sutures are tied together, one suture threaded through each half of the button, the needle and tension suture then inserted into the skin, through the incision, and out through the skin of the opposite side. The tension sutures are then threaded through a second button and the desired tension maintained when the sutures are tied together. Thus, the suture material is kept from cutting the skin. In removing the buttons, the sutures should be cut between the wing and body of the button. By doing this

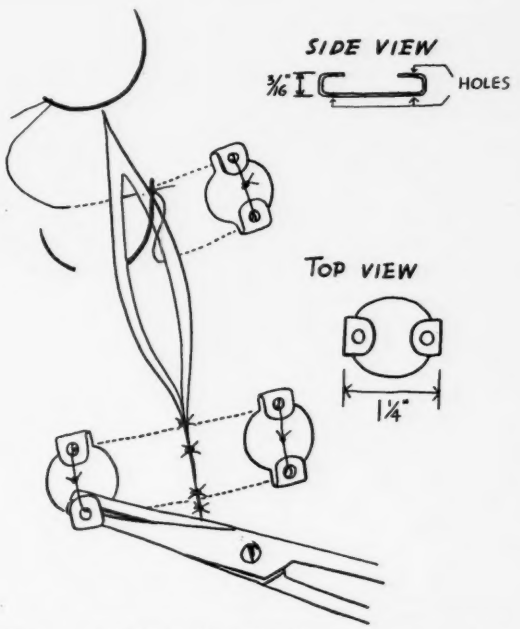


FIG. 1. Method of application and removal of tension suture buttons.

a smooth end of suture material is left. There are no "hooks" of dried suture material to be pulled through the skin to the discomfort of the patient.

SUMMARY

A button is described for holding tension sutures in such a way that the skin is not cut when tension is applied by means of sutures.

REFERENCES

1. Lister, Joseph. On recent improvements in the details of antiseptic surgery. *Lancet*, 1: 787, 1875.
2. Gerster, A. G. The Rules of Aseptic and Antiseptic Surgery, pp. 116–117. New York, 1891. D. Appleton.
3. Pick, T. P. Surgery, p. 65. New York, 1899. Longmans, Green.

Stored blood can be administered by ordinary gravity, by some form of pressure apparatus, or as a continuous drip. It must always be filtered. From—"War Wounds and Air Raid Casualties" (Lewis).

BOOK REVIEWS

ANAESTHESIA: NARCOSIS; LOCAL; REGIONAL; SPINAL. By A. M. Dogliotti, M.D. Translated by Carlo S. Scuderi, M.D. Chicago, 1939. S. B. Debour. Price $7.50.

We can recommend this book to any surgeon who wishes to add to his knowledge of anesthesia. It is replete with valuable facts and observations. The illustrations are above the average. The eleven chapters are divided into three parts, the first dealing with the historical background, pathways of sensibility and the pathologic physiology of pain, as well as the examination of the patient and preoperative care. Part 2 deals with narcosis, while Part 3 considers peripheral anesthesia. This latter section will prove valuable to the surgeon who wishes to be more familiar with regional anesthesia, spinal anesthesia, etc. This book of 680 pages from the pen of an Italian physician gives the results of his experience in this work. In translation it can now find a definite place in American literature.

SCLEROSING THERAPY. Edited by Frank C. Yeomans, M.D. Baltimore, 1939. Williams & Wilkins. Price $6.00.

Although hundreds of articles on the subject of sclerosing procedures have appeared in the various surgical journals in the past five years, it is well to have a book that covers the subject in detail from every angle. This work is written by four authors and is really a series of four monographs gathered together in book form. Arthur F. Bratrud writes on The Injection Treatment of Hernia; George F. Hoch on Injection Treatment of Hydrocele; Harold J. Shelley on Injection Treatment of Varicose Veins; and Frank C. Yeomans on Injection Treatment of Hemorrhoids. The reader can, on the basis of the data presented, judge for himself the value of the technique offered.

TEXTBOOK OF THE PRINCIPLES AND PRACTICE OF NURSING. By Bertha Harmer, R.N., A.M. and Virginia Henderson, R.N., A.M. Fourth Edition. New York, 1939. Macmillan. Price $3.00.

This widely used textbook on the principles and practice of nursing first appeared in 1922. Added editions came out in 1928 and 1934, and in this, the fourth edition, the authors have thoroughly revised the work and made it conform more nearly to the curriculum guide published by the National League of Nursing Education in 1937. A new sequence of topics has been adopted, the scope of the text enlarged and techniques included that were not in general use when the third edition was published.

The book is divided into five parts: nursing and community health service; fundamentals of nursing care; assisting with diagnostic procedures; assisting the physician with therapeutic measures; introduction to medical and surgical nursing.

This book of over a thousand pages is clearly illustrated, and the writers happily have a pleasant and entertaining style. One need give little praise to a work that has become standard and now comes to us in a fourth edition. A good, large book at a very low price.

FUNCTIONAL DISORDERS OF THE FOOT—THEIR DIAGNOSIS AND TREATMENT. By Frank D. Dickson, M.D., and Rex L. Diveley, M.D. Philadelphia, 1939. J. B. Lippincott Company. Price $5.00.

This book was not written for the layman, but for the physician. It does not concern itself with pet theories, but discusses sound facts derived from personal observation and experience on the part of the authors.

Much space is given to a consideration of the foot in childhood and adolescence, for the authors feel that this period of life sees the beginning of many foot disorders. This 305 pages of text have 202 illustrations. The book is written for the understanding of the man in general practice, and is intensely practical.

It is about time that doctors of medicine knew more concerning disorders of the foot, and that the public learned to seek the physi-

cian and not a cutter of corns or a shoe salesman for the treatment of these conditions.

THE NEUROGENIC BLADDER. By Frederick C. McLellan, M.D. Springfield, 1939. Charles C. Thomas. Price $4.00.

The author in this book of 206 pages has not presented original material, but has correlated the literature on the subject and presented in a readily understandable form the problem of the neurogenic bladder as a result of disease of special location in the central nervous system. This volume gives the student or diagnostician a working knowledge of the value of cystometry in the differential diagnosis of neurogenic and non-neurogenic diseases of the bladder. The appendix includes a synopsis of one hundred neurogenic bladders with pertinent data and fifty-seven figures and charts to illustrate the text. This is a worthwhile work, well presented, offering bibliography and index.

THE PHYSIOLOGICAL BASIS OF MEDICAL PRACTICE. By Charles Herbert Best, M.D. and Normal Burke Taylor, M.D. Second Edition. Baltimore, 1939. Williams & Wilkins. Price $10.00.

This unexcelled work first appeared in 1937. In two years' time it has been reprinted four times, and now appears in a new and larger edition.

The text, we are told, was written with the view of enabling the student to bring physiologic principles into more intimate relationship with the problems at the bedside. The book is long—eighty-one chapters, 1,972 pages, something for which neither authors nor publishers need apologize, for not one page could be spared. It is beautifully written and well illustrated. The references cover eighty-one pages, and the book is indexed in detail.

This is a short review, but an important, "must" book, already known as the best in its field, needs but few words to commend it.

THE SURGERY OF INJURY AND PLASTIC REPAIR. By Samuel Fomen, PH.D., M.D. Baltimore, 1939. Williams & Wilkins Company. Price $15.00.

Great strides have been made in the field of traumatic and plastic surgery during the past two decades, largely because of the increasing number of injuries due to industrial mechanization, transportation, and greater sports activity.

The author has had twenty-five years' experience in lecturing to post-graduate students and army surgeons on the subject of trauma. He divides his book into two parts, the first on general principles and the second, a regional surgery of the exterior head. The author says he intended covering the entire body, "but the impossibility of incorporating so vast an amount of material under one cover soon became apparent . . . "

The volume begins where pathologic and remedial surgery leaves off. Steps of operations are carried through to physiologic rehabilitation and anatomic restitution. Usual surgical procedures to be found in textbooks are omitted. There are about a thousand illustrations, mostly clearcut line drawings, with a great many in color.

The book is 1,409 pages long, has adequate references at the end of each chapter, and an index.

ENDOCRINE GYNECOLOGY. By E. C. Hamblen, M.D., F.A.C.S. Foreword by J. B. Collip, M.D. Springfield, 1939. Charles C. Thomas. Price $5.50.

This book is for the general practitioner, and has developed from the author's lectures on endocrine gynecology. New facts in this field seem to come to light almost every month, but the author nevertheless manages to present his subject, covering the field adequately. The sections dealing with therapeutic substances and their potency will prove an aid to the general man in every day work. The cost of drugs and the values of diagnostic equipment are carefully analyzed. The illustrations (169) are excellent and different, some being in color. The book is 453 pages long, has references at the end of chapters, and subject and author indices.

SPECIAL MONOGRAPH

PLACENTA PREVIA

Roentgen Diagnosis, Treatment, and a Technique for Induction of Premature Labor

BY

JULIUS JARCHO, M.D., F.A.C.S.

Attending Obstetrician and Gynecologist, Sydenham Hospital

AMERICAN JOURNAL OF SURGERY, Inc.

NEW YORK · MCMXL

TABLE OF CONTENTS

	Page
1. History and Literature	485
2. Incidence	487
3. Etiology	488
4. Diagnosis	488
Roentgen Diagnosis of Viability	491
5. Methods of Treatment	492
Braxton Hicks' Podalic Version	493
Metreurysis	493
Bougies	494
Rupture of the Membranes	496
Cesarean Section	497
6. Value of Vaginal Tamponade	501
7. Author's Method of Inducing Labor	501
8. Description of Author's Technique	503
9. Discussion	507
10. Case Reports	508
11. Summary and Conclusions	519
12. References	519

PLACENTA PREVIA*

ROENTGEN DIAGNOSIS, TREATMENT, AND A TECHNIQUE FOR INDUCTION OF PREMATURE LABOR

JULIUS JARCHO, M.D., F.A.C.S.

Attending Obstetrician and Gynecologist, Sydenham Hospital

NEW YORK CITY

ONE of the most brilliant achievements in modern obstetrics has been the significant reduction in maternal and fetal mortality from placenta previa. The sense of helplessness which this tragic and little understood condition inspired in accoucheurs of a past age, who had no adequate weapons or knowledge with which to handle it, has given place to a spirit of confidence as new avenues of approach have been found to a solution of the difficulties that formerly seemed insuperable in its management.

This brighter outlook for placenta previa has been brought about in part by the discovery of means for its prompt and exact diagnosis and in part by the utilization of more effective methods of treatment, as well as improved technique in the older methods of procedure. It is evident that there is no standard and universal form of treatment applicable to all cases of placenta previa, but that according to the particular conditions in the individual case one or another type of procedure is indicated.

The main purpose of this paper is to evaluate the different modes of treatment in use today, and to present a method of inducing labor which the author has found useful in certain types of cases, as well as applicable in some instances of placenta previa.

HISTORY AND LITERATURE

Placenta previa was already known to Hippocrates, who wrote: "The afterbirth should come forth last, for if it come first, the child cannot live, because he takes his life from it, as a plant does from earth. . . . When the afterbirth comes first, the child remaining within, loses its respiration and nourishment, without which it cannot live."

* From the Department of Obstetrics and Gynecology, Sydenham Hospital, New York City.

Early writers, however, supposed that the placenta had accidentally changed its position during pregnancy from a site higher up within the uterus to a position in the uterine os. In the middle of the last century Read wrote a graphic account of the attitude taken by accoucheurs of the seventeenth and eighteenth centuries towards placenta previa.

Between 1664 and 1671 Portal reported four cases that were quite evidently placenta previa. In the first, he "separated the placenta from the internal os, to which it adhered." In another he "felt the after-burthen fastened quite round the circumference of the orifice," thus proving that he knew the placenta was attached there when found. But Van Deventer in 1734 still wrote of the "falling of the placenta" and of the flooding that it causes. In 1730 Edward Brunner wrote a thesis on "The Insertion of the Placenta over the Internal Orifice of the Uterus." Four years later William Giffard, in a treatise on midwifery, recorded many cases of placenta previa, but he too referred to the placenta as having "sunk down to the mouth of the womb."

The first record of version to stop hemorrhage of placenta previa was published by William Smellie in 1743. This author stated that he "delivered the child by the feet and so prevented the placenta from coming down first."

Mauriceau (1752) recorded his belief that when the placenta presents, it is always wholly detached, and that it acts as a foreign body which should immediately be brought away. In 1753, Wessel differentiated central and lateral insertion of a placenta previa and insisted upon rupture of the membranes before partial separation of the placenta occurred.

Levret, in his "Art des Accouchemens" (1753), wrote a chapter "to prove that the placenta may be situated on the os uteri without having been previously separated from some other part and pushed down there."

In 1775, Rigby published his classic "Essay upon Uterine Haemorrhage," in which he divided such bleedings into "accidental" (abruptio placentae) and "unavoidable" (placenta previa). As a result of several dissections, he was convinced that there must be a partial separation of the membrane in the space between the placenta and the os uteri to allow of the discharge of blood into the vagina, but that a separation of the membranes such as would admit of the

placenta's falling down could never take place before delivery of the child.

Rigby's view was soon universally accepted, and the literature of the subject since his day has been concerned chiefly with methods for early diagnosis and for prevention of these "unavoidable" hemorrhages which destroy so many lives.

Writing in 1837, Renton reviewed the subject and stated: "No person can have the slightest difficulty in believing that Portal, in 1683, knew as much on the subject of uterine hemorrhage, occasioned by the displacement of the placenta from the *os uteri*, and the practice necessary for its suppression, as we do at the present time. It is to him unquestionably that we are indebted for our knowledge on the subject."

INCIDENCE

The figures for incidence of placenta previa are various. Stander in 1936 placed it roughly as "once in 1000 cases in private, as compared with once in 250 cases in hospital practice." Daily gives it as 1 in 115 in the Chicago Lying-in Hospital; Aldridge as 1 in 137 for the Woman's Hospital (New York); Parks as 1 in 158 for the Sloane Maternity Hospital; Vaux as 1 in 198 for the Jefferson Maternity and the Philadelphia Lying-in Hospitals; Irving as 1 in 92 for the Boston Lying-in Hospital; Danforth as 1 in 133 for Northwestern University Medical School and Evanston Hospital, while Ude, Weum and Werner record it as only 1 in 346 at the Minneapolis General Hospital.

Beck states: "True placenta previa is rare and occurs about once in every 500 obstetric patients. . . . In hospital practice, placenta previa is observed in about 0.5 to 1 per cent of all maternity admissions."

Among causes of obstetrical deaths, Daily cites figures from the United States Department of Labor for fifteen states that would reveal a mortality of 1 in 18 from placenta previa. DeLee, averaging reports from twenty different parts of the world, found a maternal mortality varying from 1 to 19 per cent, and a fetal mortality of from 10 to 80 per cent. He states, however, that such figures are very misleading because so many different factors are involved, many of which are beyond our control. Since cesarean section has become a

common procedure in placenta previa, the mortality for both mothers and babies has been significantly reduced.

ETIOLOGY

Nearly all authorities agree that placenta previa is the result of some defect in the endometrium resulting in faulty implantation of the placenta. Strassmann was the first to suggest that a preceding endometritis (inflammatory or atrophic changes of the endometrium) leaves a poorly vascularized bed, which causes the placenta to spread overmuch in its attempt to bring adequate nutriment to the fetus. As evidence of this excessive spreading, Morton states that "even after the placenta has located itself, it may spread out over a larger area if for some reason the soil is inadequate. It is well known that placentas from cases of placenta previa are frequently very extensive in area, though they may be quite thin."

An interesting case is described by Thompson in which a placenta previa centralis "filled out the entire uterine segment like a cup."

Strassmann's explanation is rather generally accepted today. Davis, however, suggests it is more probable that abnormal factors in transportation of the fertilized ovum bring it too near the internal os, but admits that we know little about such factors. However this may be, it is clear that when the placenta is attached low in the uterus, near the os, there must inevitably be changes that interfere with its attachment as the uterus increases in size and the lower uterine segment forms. The increased vascularization that necessarily results from its presence here cannot fail to impair the integrity of the tissue, making it an easy prey to lacerations and hemorrhage in the later months of pregnancy. Bland points out that bleeding is further favored by the fact that the lower uterine segment is unable to contract, and the living ligature action of the interlacing fibers of the upper segment is absent. The blood is mostly from the uterine wall, not from the detached placenta. Even a slight tear in one of the sinuses in this wall may cause uncontrollable bleeding.

DIAGNOSIS

Traditionally, the diagnosis of placenta previa has been made on the basis of painless uterine bleeding occurring during the last three months of pregnancy. It has been confirmed by abdominorectal and vaginal examination, which reveals a portion of the placenta lying over the internal os.

Within recent years, however, the Roentgen ray has been called into use in this field and has opened up new means of diagnosis that are of the greatest value.

After attempts by Menees, Miller and Holly, in 1930, to reach a diagnosis by injection of strontium iodide directly into the amniotic sac (amniography) had proved too dangerous to fetal life, Kerr and Mackay (1933) tried the introduction of an opaque substance through the os uteri, only to find that this too tended to terminate pregnancy.

The method employed by J. M. Munro Kerr (1937) is to inject 20 c.c. uroselectan B into the amniotic sac through the abdominal wall. The injection should be made on the side opposite to that to which the child's back is directed. Radiographs are taken about an hour after the injection. The placenta is demonstrated as a filling defect in the outline of the amniotic cavity. While there is no bad effect on either the mother or child, this procedure tends very definitely to induce labor.

Snow and Powell are of the opinion that Roentgen visualization of the placenta in utero is important both from a clinical as well as a theoretical point of view. In a very high percentage of cases, the placenta was demonstrated in the routine examination of the abdomen of the pregnant woman.

To Ude, Weum and Urner, however, belongs the credit of utilizing cystography effectively for the diagnosis of placenta previa. Using 40 c.c. of 12.5 per cent aqueous solution sodium iodide as an opaque medium, these workers demonstrated that in cases of normal placental implantation in which the head presents, the space between the shadow of the fetal skull and that of the bladder is very slight, amounting to scarcely more than 1 cm., since the only tissues intervening are the delicate scalp of the fetus, the walls of the lower uterine segment and bladder, and a thin fold of intervening peritoneum.

On the other hand, in placenta previa they found that the presence of the placenta in this space could usually be recognized by the image of a soft crescentic mass lying between the fetal head and the bladder, separating these two structures by a space considerably wider than normal (2–3 cm.). They noted further that the size and position of the placental mass could be made out sufficiently clearly to enable them to determine whether it was a total (central) or a partial placenta previa. If it was partial, the crescent was wider on one side than on the other. Obviously this method can be of use only

in cases in which the head presents in the lower uterine segment, and is inapplicable in transverse or breech cases.

To obtain these roentgenograms, Ude and his associates used a large-sized film with the central ray directed vertically over the lower part of the abdomen. A Bucky diaphragm and a fast technique were necessary. When these conditions were fulfilled, they found it possible to make the diagnosis with a high degree of accuracy. In their first series of thirty-five cases of abnormal uterine bleeding, fourteen showed in the roentgenogram as placenta previa, and all but one of these were corroborated at delivery.

The great advantage of this method of diagnosis lies in its safety for both mother and fetus. This is due to the fact that a correct conclusion can be reached without inviting further hemorrhage by invasion of the uterus, and without danger of infection of the genital tract. In the past, when vaginal and rectal exploration in the home were the only means available for making a diagnosis, patients were exposed to all manner of possible infection, and slight bleeding easily became profuse hemorrhage under the manipulations to which they were necessarily subjected.

The value of this method was quickly recognized, and its use spread rapidly. Beck and Light reported on seventy-one cases of bleeding in the last three months of pregnancy, in which they used the method. Seventeen of these cases were placenta previa and the diagnosis by cystogram was correct in thirteen (76.5 per cent). The authors point out, however, that its greatest value is in ruling out placenta previa with a fair degree of accuracy.

McIver took up its use in all cases of painless bleeding during pregnancy, and made a report on eight cases in which the presence of a suspected placenta previa was confirmed. Titus reported that the new method, taken in conjunction with the clinical sign of bleeding and the findings of abdominal examination, enabled him to make a diagnosis of placenta previa without resorting to vaginal examination, and that the relations of the placenta to the uterus were confirmed at cesarean section.

While conceding the usefulness of the cystogram, Davis considers that the diagnosis still rests on the findings at vaginal examination, and that the presence of placental tissue covering part or all of the uterine os is diagnostic.

It is my experience that the cystogram has definitely made diagnosis simpler and easier. Although it has not supplanted vaginal

examination, in my opinion it represents one of the most valuable contributions toward the timely recognition of placenta previa, and has already been the means of saving many lives, both maternal and fetal.

It is well, however, to point out that while a negative cystogram is usually conclusive for excluding placenta previa, in an occasional case, when the placenta overlies mainly the posterior portion of the cervix, one may obtain a negative result notwithstanding the existence of a placenta previa.

Very recently Prentiss and Tucker, in an attempt to improve the contrast medium, made studies of the same kind with air cystograms. They claim that these provide a clearer, simpler and more accurate method of delineating the bladder than any liquid opaque medium that has been tried. They confirmed the high degree of accuracy of the cystographic method of diagnosing placenta previa. Five of twenty-three patients with antepartum bleeding had placenta previa. Four of these were accurately diagnosed from air cystograms, the fifth being only "suspicious." In eighteen cases placenta previa was accurately eliminated. In a breech case the air cystogram was inconclusive, just as occurs with iopax cystograms.

Roentgen Diagnosis of Viability. There is another way in which roentgenography renders diagnostic aid in cases of placenta previa, in that it reveals whether the fetus has reached an age when it is viable. In determining a method of treatment, it is as important to know the approximate age of the fetus as it is to recognize the cause of the bleeding and the type of implantation of the placenta at the os. A fairly accurate conception of the age of the fetus in utero may frequently be obtained by studying the degree of bone development in the plain roentgenogram. It is possible to roentgenograph the bony system of the fetus and to determine the extent to which ossification of the bony structures has taken place. This method is more reliable than determination of age by fetal measurements, which are always subject to variations dependent on nutrition, disease, traumatism, heredity and family traits. This subject has been discussed in my monograph, "The Pelvis in Obstetrics."

Hess, in 1917, and Dorland and Hubeny, in 1926, recorded the dates of appearance of the various centers of ossification as revealed by Roentgen rays.

It thus becomes possible to determine whether a fetus is sufficiently developed to survive the ordeal of birth. On the basis of this

knowledge, one may choose a suitable method of delivery. This is a matter of utmost importance in placenta previa.

METHODS OF TREATMENT

It has been well said by Williams that there is no single method of treatment applicable to all cases of placenta previa, and that the accoucheur who understands how to differentiate cases will obtain the best results.

In choosing the method of delivery, it is essential to take into consideration not only the variety of placenta previa, but also whether the child is living, viable, nonviable or dead. In addition, it is important to exclude the presence of monstrosities. Many of these points may be determined by roentgenography.

In olden days, the only thought of the physician was to staunch the flow of blood as quickly as possible, by any means at hand. It was not fully known that the hemorrhage, as Greenhill points out, is always associated with the rupture of some vessels which cannot be compressed until after the uterus is emptied. The old style vaginal tamponade, with material none too clean, applied by unskilful hands and in an inadequate manner, was the first recourse, and failed to accomplish its purpose. Even though it occasionally postponed death of mother and fetus, it was followed by infection and resulted disastrously. "Watchful waiting" where bleeding was at first not profuse has resulted in many a death from sudden hemorrhage in patients not under the immediate eye of the physician, and without hospital facilities close at hand. Transfusion was unknown, and bleeding to death was only too common, with loss of both mother and fetus.

The years have brought changes in our understanding of placenta previa. We now know that except in rare cases that can be kept under constant supervision, and in which the fetus is nearly viable, a quick means must be found to empty the uterus, combined with modern supportive measures to keep up the failing strength of the mother, chief among which is replacement of blood by transfusion. Placenta previa, as Schumann says, is a lesion requiring expert management and should never be treated in the home by one inexperienced.

I shall here discuss briefly the most important methods in current use for controlling hemorrhage and emptying the uterus. These are:

1. Braxton Hicks' podalic version
2. Metreurysis (hydrostatic dilatation of cervix by bag)
3. Rupture of membranes
4. Scalp traction forceps (Willett's forceps)
5. Cesarean section
6. Gauze tamponade or pledgets of cotton
7. Author's method.

The choice of a method depends upon various factors, including the degree of placenta previa, the viability of the fetus, the general condition of the mother, the amount of dilatation of the cervix, whether there is infection, and whether the patient is at home or in a hospital. For we must recognize that in country districts, many of these cases must perforce be cared for in the home, undesirable as this may seem. Perhaps the most important factor of all is the experience and skill of the accoucheur, his ability to make the right choice of a method and to carry it through successfully.

Braxton Hicks' podalic version is limited in its application to cases in which the cervix is sufficiently dilated to admit two fingers. It consists in turning the fetus within the uterus (always under an anesthetic) in such a way that a foot can be brought out and drawn down until the buttocks of the fetus serve as a tampon to stop the flow of blood from the torn vessels, by compressing the placenta against the cervix. It is a procedure requiring great skill for its correct execution, but has the advantage that it can be done within the home in cases where removal to a hospital is out of the question. Its disadvantage is that it usually results in a dead fetus. No attempt should be made to extract the fetus until dilatation is complete, and this may mean hours or even days of waiting. Some practitioners tie a weight to the infant's foot to hold the buttocks fast against the cervix. If it is clear that the child cannot live in any event, some authors, as Titus, consider version better for the mother than a cesarean operation. While this method is most applicable in partial placenta previa, where the edge is easily located, in total (central) placenta previa, it is necessary to perforate any area which can be reached most easily.

Metreurysis (*Vorhees' bag method*) should be employed in hospital practice only. Like version, it is most applicable in partial or marginal placenta previa. The bag is of soft rubber and is collapsible. It is inserted collapsed within the cervix when there is but slight dilatation. Its action, when water is gradually introduced within it, is both

to dilate the cervix and to stimulate labor pains. As a rule, no anesthetic is necessary. The bag, which should be at least 10 cm. in diameter, is kept taut against the placenta by attaching a 1 pound weight that hangs over the foot of the bedstead. In some cases the pains do not begin for several days, and it is necessary to change the bag from one size to another every twenty-four hours until a size is reached that will complete dilatation and permit expulsion of the fetus.

Bougies. The use of the bougie for the general induction of premature labor was employed by Krause, who wrote a monograph on the subject in 1855. In view of the fact that Krause's original work was unavailable, it is not possible to state whether this method was employed in cases of placenta previa.

According to DeLee, Krause introduced one or two elastic solid bougies into the uterus between the membranes and the wall. In two cases in which DeLee used this method for induction other than for placenta previa, the bougie caused severe hemorrhage by encroaching upon the placenta. It is thus evident that the greatest gentleness must be employed in their insertion, and that they should never be forced within the uterus in the face of resistance. The bougies, when introduced for the induction of labor in any condition, should be of soft rubber, able to curl upon themselves. In my opinion, Krause's original method would be contraindicated in placenta previa.

I have used a small soft rubber bougie with most satisfactory results in these cases, and shall deal with this subject when describing my method of inducing premature labor. Under no circumstances, however, must dilatation be hastened by manual interference. Kerr has called such a practice "the worst of all possible methods." DeLee utters a strong warning not to do hasty extraction through a poorly dilated cervix. Even the rubber bag, if overdistended and hard, may rupture an undilated cervix if not properly handled.

To insert the bag the membranes must be ruptured, and in the total (central) variety the placenta must be perforated. Some accoucheurs insist that the bag be inserted intra-ovularly in order to afford better control of bleeding. Ekas points out that extra-ovular insertion separates the placenta farther from the uterine wall, causing more concealed bleeding. Others, including La Vake, consider that the chance of getting a live baby is greatly increased if one tampons the placenta and dilates the cervix with a bag intro-

duced extra-ovularly. In either case, the patient must be watched constantly, never being left alone for a minute. She must be delivered promptly after the dilatation is complete and the bag expelled, since there is imminent danger of further hemorrhage at this moment.

I do not favor the use of a bag, for I have found that it has a tendency to increase hemorrhage. The lower segment of the uterus contains little hemostatic or contractile tissue, and is extremely friable. The extensive vascularization caused by the presence of the placenta here makes it bleed all the more readily, even though manipulations are very gentle. The several changes that may be required from one size bag to another increase the number of manipulations and invite further damage to the tissues. When the bag is expelled, if not closely watched it may lodge within the vagina while concealed bleeding continues above it. After its use the baby must still be delivered, and the maneuvers required for this accomplishment may be more than the mother can sustain in her already exhausted condition. In some of these cases version is still necessary after expulsion of the bag.

Regarding the bag as distinctly unconservative, Bill points out that it inevitably stretches and traumatizes the placental site and may thus cause postpartum bleeding. DeLee observes that the bag sometimes displaces the baby's head and allows malpresentations and prolapse of the cord, killing the baby. Even if compression of the cord does not cause disaster, the fetus is liable to suffer some degree of asphyxia, since the head cannot be delivered until the cervix is dilated, and dilatation in haste is strictly forbidden. Adair usually rules out the use of a bag except where the "life of the fetus is already extinct or of no particular value." Davis points out various practical objections to the use of the bag in the treatment of placenta previa.

Baumm advocated the use of a goat's or other animal's bladder as a metreurynter, into which glycerin is injected after its insertion into the uterus. He used this method in some 200 general obstetrical cases (type not specified), and declared that it was effective in a large percentage of these. In addition, it was wholly without danger to the mother. Not only did the bladder act as a bougie, but by osmosis the glycerin passed through the wall of the inserted bladder into the uterine cavity, where it set up contractions, often within ten minutes, through the specific irritant effect of the glycerin upon the uterine muscles and nerves.

As a general method for induction of premature labor, Klein (1926) substituted for the metreurynter and colpeurynter (vaginal bag) a Barnes' balloon, shaped like a violin, which he introduced into the rectum. Fitting the lower rectum well, this bag, to which he gave the name *procteurynter*, went high enough to reach the region where the sacrouterine ligaments branch out around the rectum. It is at this point, nearer to the rectum than to the vagina, that the ganglionic plexuses (Frankenhäuser's ganglia) are found, and according to Klein the "procteurysis" action consists in a stimulation of these ganglia, which he regarded as the centers for uterine contractions. Right here is the point of application of the procteurynter, which is designed to bring pressure upon these ganglia. The bag, well greased and tightly rolled, is introduced into the rectum as high as it will go, great care being taken not to kink it. It is then filled with hot water (45°C.). Klein stated that it is usual to observe labor pains after three or four hours, and at most, after six to eight hours. The bag causes no pain in the rectum and no bleeding.

Klein explains the action of the procteurynter definitely as the result of the pressure it exerts upon the Frankenhäuser's ganglia. He states that it has the additional advantage of avoiding infection, speeding up the outflow of secretion and making pressure upon the portio, resulting in dilatation of the os.

The stimulation of Frankenhäuser's ganglia is a matter which I consider of such definite importance for the induction of labor that I shall return to this subject later on.

Rupture of the membranes is often the best procedure in cases of partial or marginal placenta previa in which the head is already engaged. This makes it possible to utilize the head as a means of tamponing the placenta. In order to use this method, it is essential to know at what point the placenta will not lie in one's path, since rupture through the placenta will precipitate more hemorrhage. Since it has become possible to recognize the site of a partial previa by means of a cystogram, it is easy, under guidance of the roentgenographic film, to determine a safe point for the puncture.

I have found this method easy and safe in some cases of placenta previa of the partial or marginal type, with head presentation and dilatation already under way. Davis points out that it has the advantage of not jeopardizing any additional treatment that may be required. It effectively puts an end to any further separation of the placenta by allowing the rigid placenta to recede along with the

lower uterine segment, and thereby halts the bleeding. It initiates labor pains and facilitates the birth of a living child, without prejudice to the welfare of the latter.

The use of *scalp traction forceps* (Willett's forceps) has gained some vogue, chiefly among the continental nations of Europe. Marshall, reading a short paper before the North of England Obstetrical and Gynaecological Society, October 26, 1934, stated that in 1925 the late J. A. Willett introduced a simple method of bringing pressure to bear on the placental site by scalp traction.

He further stated that "the knowledge of the Willett's forceps is not so widespread as might have been believed." However, this method was reintroduced independently in the Wurzburg Clinic in 1931 and has since become more generally known.

Willett proposed that the scalp of the fetus be grasped with a Museux forceps, to which was attached a string hung over a pulley, with a weight not in excess of 1 pound at its other end to exert continuous traction. This results in the fetal head's making pressure upon the placenta and the uterine lower segment, which stops the bleeding and at the same time stimulates contractions and dilates the cervix. Lesions to the scalp are said to be minimal and to heal readily, without permanent injury. This method was at first used only when the fetus was known to be dead, but by degrees it began to be applied in cases of nonviable babies, and finally, on living babies at term, who were delivered in this manner without serious injury.

In a recent report on this method, Schehl states that the technique is simple, the results good, and that in the main there is no damage to the baby. The treatment is, however, directed principally to the mother, so "an occasional dead baby is to be expected." He states, nevertheless, that the mortality of the babies was two-thirds less than for combined version. The method is of course indicated only for head presentations.

According to DeLee, the use of this technique caused a 50 per cent mortality of babies in Dr. Benaron's group, and 7 per cent mortality to mothers. DeLee considers that the method has its place, however, and is as good as version or metreurysis when used on the same class of cases. He suggests that an "eight-pronged vulsellum" is just as good as a special scalp traction forceps.

Cesarean section is relatively a newcomer among methods of handling placenta previa. According to Mackenzie, who published

statistics on 22,115 cases, its use is on the increase only in the United States. Here the records show that whereas it was employed in only 13 per cent of cases in the five-year period 1924–1928 inclusive, its use was reported in 45 per cent of cases between 1928 and 1933. The general attitude in this country is perhaps reflected in McIver's comment: "Too many sections are being done, but not too many for placenta previa."

A further statement by Mackenzie would indicate that an increase of 32 per cent in the incidence of abdominal delivery in placenta previa has been accompanied by a decrease of about 5.5 per cent in maternal mortality. There was almost no mortality in the partial or marginal varieties from cesarean section, and in each degree of previa this method gives a lower mortality than does vaginal delivery. He concludes that in general the risk for the mother and baby in placenta previa is less when delivery is terminated by cesarean section than it is following vaginal delivery.

In an analysis of 47,828 cases of placenta previa in the literature, which he divided into two groups, those before and those after 1921, Findley found that the use of cesarean section had increased from 6.07 per cent in 1922 to 15.29 per cent in 1938, while maternal mortality had been more than halved, and fell well below that from vaginal delivery. His tables showed that repeated, prolonged or complicated manipulations greatly enhanced the risks to both mother and fetus.

Aldridge and Parks, reporting on the percentage of viable babies that lived after delivery, in a series studied at the Woman's Hospital and the Sloane Maternity Hospital in New York, found this to be 67.7 per cent for vaginal delivery and 85.5 per cent for cesarean at the Woman's Hospital, and 56.8 per cent for vaginal and 93.2 per cent for cesarean delivery at the Sloane Hospital.

In a recent series of ten cases of placenta previa treated by low cesarean operation, Trillat had no maternal, and only one fetal death. In eighty-eight cesarean deliveries in placenta previa, Frey had only one maternal death. Siegel, who reported two earlier series with a maternal mortality of only 2.2 and 1.72 per cent respectively, has in his latest series of 101 cesarean operations for placenta previa had only one maternal death (0.99 per cent) and twenty-five fetal deaths (24.75 per cent).

In a very recent review of the subject, Davis states that representative statistics indicate that the gross fetal mortality in cesarean

section for placenta previa averages 15 per cent, while vaginal fetal mortality is double or triple this number. This reduction in fetal mortality constitutes one of the strongest arguments for the use of the abdominal method of delivery in placenta previa totalis (centralis) where the fetus is viable and the mother able to bear a major operation.

In all cases of total (central) placenta previa in which the child is viable and in good condition, and in which there are no contraindications, it is advisable to perform a cesarean section, preferably of low flap type, as the safest procedure for mother and baby. There is general agreement, however, that section is permissible in any case in which it appears that vaginal delivery will be accompanied by disastrous bleeding.

As a rule, infection of the vaginal tract from repeated examination under conditions not strictly aseptic is a contraindication to cesarean operation. However, there are conditions under which one should even run the risk of infection rather than let the patient die of hemorrhage and exhaustion. Contraindications are also found where the fetus is nonviable, where the shock from loss of blood is too severe, in cases of uncompensated myocarditis, toxemia or poor general condition from any cause. It is obvious, too, that in cases of contracted pelvis or of abnormal presentation, a cesarean may be the only means of delivery.

These very malpresentations are often the result of the abnormal position of the placenta, which not infrequently interferes with the proper engagement of the presenting part. Success depends largely upon a wise selection of cases and the ability of the accoucheur to choose the best type of section, and to carry out its technique with the requisite skill.

Although the majority of accoucheurs prefer a classic cesarean, on the ground that it avoids the friable tissue of the lower uterine segment, one must bear in mind, in doing such a section, that the placenta if normally implanted may be encountered in the line of incision. Thus, the specific argument for giving preference to classic cesarean in placenta previa is fallacious.

My own preference is for a low flap section, since this allows full inspection of the site of attachment of the placenta—a matter of great importance. As DeLee points out, one can see the field in plain view, and it is possible to tampon or suture the sinuses of the placental site, according to the indications. One has direct access to

the source of the bleeding, and can see precisely what needs to be done.

Aldridge and Parks, who also prefer the low incision, observed that if delivery is quick, before the lower uterine segment has time to dilate, the tissues of this segment tend to retain such hemostatic power as they possess. The avoidance of trauma is one of the greatest advantages of cesarean delivery, whereas in vaginal delivery the element of traumatism is one of the most dangerous factors for the mother.

Transfusion has become an indispensable element in all these methods of treatment. Bill, in 1927, was the first to call attention to the necessity of this emergency procedure in every case of placenta previa in which there has already been an important loss of blood. He felt that in the past there had been too great haste on the part of physicians in delivering patients with placenta previa, with too little concern for the maintenance of the mother's strength by replacement of blood loss. In his own words: "If one were to analyze critically any list of fatalities from placenta previa, he could write across a large number, 'Should not have been delivered without blood transfusion,' and of nearly all the rest, 'Should have been delivered by cesarean section.'"

By introducing this supportive treatment, Bill reduced his own maternal mortality from 11 per cent to 1.78 per cent. Since one must work fast, however, he recommended that there be a transfusion team and a team for delivery which could coöperate without loss of time. At present, such an arrangement is followed in most well-organized institutions.

The improved results in placenta previa today are due as much to this replacement of blood as to the actual delivery of the patient. No treatment is good that does not protect the patient from the shock that attends profuse hemorrhage. In every case, the patient should be typed, and a donor held in readiness, in the event of blood replacement becoming an urgent need. Many of these patients require transfusion both before and after delivery. DeLee has well said that nowadays transfusion has become our best friend in hemorrhage cases.

According to Aldridge and Parks, the outstanding fault of most treatment in the series of cases reported by them was the failure to provide adequate replacement of blood loss. When a patient is in a state of shock, no attempt to deliver her by either the vaginal or the

abdominal route should be undertaken until the loss has been replaced.

VALUE OF THE VAGINAL TAMPONADE

In recent years, the vaginal tamponade has been regarded with some distrust by many accoucheurs, who rightly condemn it as useless or nearly so when it is inserted without a proper technique, as frequently occurs. Ekas states that it wastes time and blood. Davis says it has fallen into complete disuse, that it has survived from a time when other means of controlling hemorrhage were not available, that it most often fails to accomplish its end of checking bleeding, and that it definitely increases the hazards of infection. Both authors refer to the common gauze pack, inserted injudiciously without any definite technique, and without a view of the cervix.

In an editorial appearing in the *Journal of Obstetrics of the British Empire* some three years ago, the statement was made that when packing was done in the home, before admission to hospital, 23.5 per cent of the patients died of sepsis, "often from a few inches of gauze." Undoubtedly, this was true. Gauze decomposes, and packing in the home is likely to be inadequate and often far from sterile.

DeLee states that packing the lower segment with gauze, for induction of premature labor, is one of his favorite methods. He does this under guidance of the fingers or in the full view provided by broad specula with the vulsellum forceps, placing a strip of gauze 3½ yards long and 3 inches wide snugly and evenly in the lower part of the uterus and cervical canal. However, DeLee does not recommend tamponade for placenta previa except in great emergency to stop bleeding until the choice of method of delivery can be decided upon.

In induction of labor in the earlier months of pregnancy, Taussig recognized the value of the uterocervical pack.

AUTHOR'S METHOD OF INDUCING LABOR

In some cases of placenta previa, the author has had striking success with his method of induction of labor, which combines the use of a small size (No. 18–20 French) soft-rubber bougie and the packing of the vagina with a chain of cotton strips. This method will

be described in detail below. Its success demands a rigorous and scrupulous technique and a clear understanding of the innervation of the uterus and surrounding regions.

In an illuminating paper published in the *Journal of Obstetrics and Gynaecology of the British Empire*, in 1933, Davis presents an excellent discussion of the subject, "The Innervation of the Uterus."

Allusion has already been made to the part played by Frankenhäuser's ganglion in stimulating labor pains. In 1867, Frankenhäuser demonstrated by animal experiments that motor fibers pass from the spinal cord to the sympathetic nerve and from this to the uterine plexus, by way of the hypogastric plexus. In addition to the fibers leading directly into the cervical ganglion, he found that a wide variety of indirect connections of the sympathetic system with the uterus is also established. He pointed out that the position of the hypogastric nerves with reference to the uterus, and the close connection of their network with the nerves of the rectum is important from a therapeutic point of view, when a means of arousing labor pains is sought.

Oertel, in 1924, stated that the topographic site of the ganglia lying around the uterus (Frankenhäuser's plexus) is important for induction of labor. Similarly, Novak asserts that, in the normal, the cervical ganglia of Frankenhäuser represent the peripheral centers for the motor functions of the uterus. "Many experiments," he says, "among which may be mentioned those made upon Frankenhäuser's ganglion, prove that nerves which excite the uterus are contained in the uterine and hypogastric plexuses, and that we may, accordingly, consider the hypogastric plexus as the exciting nerve for the uterus."

DeLee points out that Frankenhäuser's ganglion, which is ordinarily ½ inch wide and ¾ inch long, grows during pregnancy to a length of 2 inches and a width of 1½ inches.

According to Stoeckel, the hypogastric plexus and the nervus pelvicus are mutually antagonistic. Since the tracts of both meet in Frankenhäuser's ganglion, he thinks that both exciting and inhibiting influences act upon the uterus from this source. He regards the automatism of the uterus as of neuromuscular origin, and as localized not only in the great cervical ganglion of Frankenhäuser, which is reinforced by paravaginal and vaginal ganglia, but also in the intramural and subserous ganglion plexuses of the uterus. He concludes, however, that it is difficult to say to what extent neurogenous and myogenous contractions combine in labor pains.

In all events, it seems evident that the pressure which is brought to bear upon the plexuses situated behind the cervix and upper portion of the vagina is what constitutes the chief value of the metreurynter, the procteurynter and the uterovaginal pack in induction of labor in placenta previa. When the vaginal tamponade is introduced with the twofold purpose of staunching hemorrhage and inducing labor, it becomes something quite different from a blind plugging of the vaginal tract with a few gauze pads pressed against the cervix.

DESCRIPTION OF AUTHOR'S TECHNIQUE

The external genitals should be shaved and scrubbed in the usual manner. If induction is done for other reasons than for placenta previa, especially in the early months of pregnancy, and if the vagina is roomy and the patient coöperative, it may be scrubbed as for any other vaginal operation. However, when the vagina is small and the introitus narrow, or when the patient cannot stand the pain of scrubbing, it is filled with 4 per cent aqueous solution of mercurochrome. The mercurochrome is allowed to run out and the vagina is again flushed with it two or three times.

Anterior and posterior vaginal retractors are introduced, and the cervix is brought to view. A No. 18 to 20 French soft-rubber bougie, with a piece of tape tied at its distal end, is gently introduced into the undilated cervix.

A volsella is seldom necessary, unless exposure of the cervix is difficult. If the method is being used for placenta previa, one must avoid use of a volsella on the cervix. In other types of cases, when a volsella is indicated, the instrument is applied very slowly, the successive teeth being locked in one at a time. If this is done, the procedure will not be disturbing to the patient. Once more the os is touched up with a swab in 4 per cent mercurochrome.

The soft-rubber bougie, when introduced in the cervix, curls upon itself between the membranes and the uterine wall at the point of least resistance.

The piece of tape already attached to the free end of the bougie is now wound around the proximal end of a sterile cotton strip 15 cm. long and 2 cm. thick. With this cotton strip the vagina is packed about the cervix, and the cotton tucked tightly into each fornix.

To the distal end of the cotton strip another piece of tape is tied, which, in turn, is tied similarly to the end of the next strip.

Thus a series of cotton plugs with tape connections is made. The last section of tape is allowed to hang out of the vagina.

The cotton packing, before its insertion, is wrung out in ½

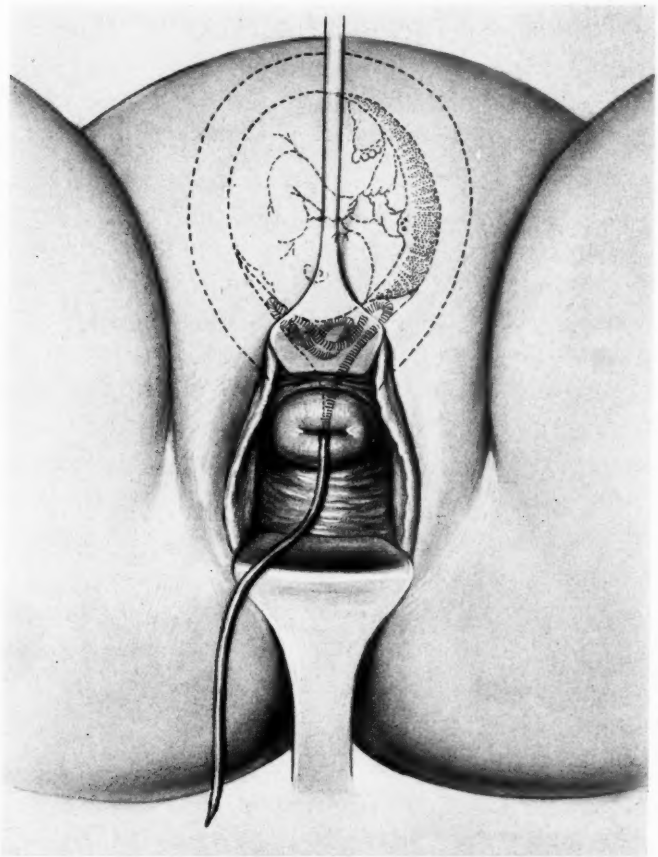


FIG. 1. Author's method of induction of labor. Anterior and posterior vaginal retractors expose cervix. Observe outline of uterus, placenta, membranes and fetus. No. 18 to 20 French, soft rubber bougie introduced into cervix. Note bougie curling in lower uterine segment indenting membranes without rupturing them.

per cent lysol solution or any other mild antiseptic, to prevent decomposition.

When the cotton strips are packed, this should be done against the blades of the retractors, in order to avoid dragging of the vaginal wall. Thus, injury to the mucous membrane as well as pain is prevented. To avoid pressure on the urethra, which may interfere with urination, the anterior retractor, when withdrawn, should be

depressed, while the packing is pressed inward with the gloved finger. By withdrawing the instrument in this manner, the pressure of the packing against the urethra is diminished and the packing will not interfere with micturition.

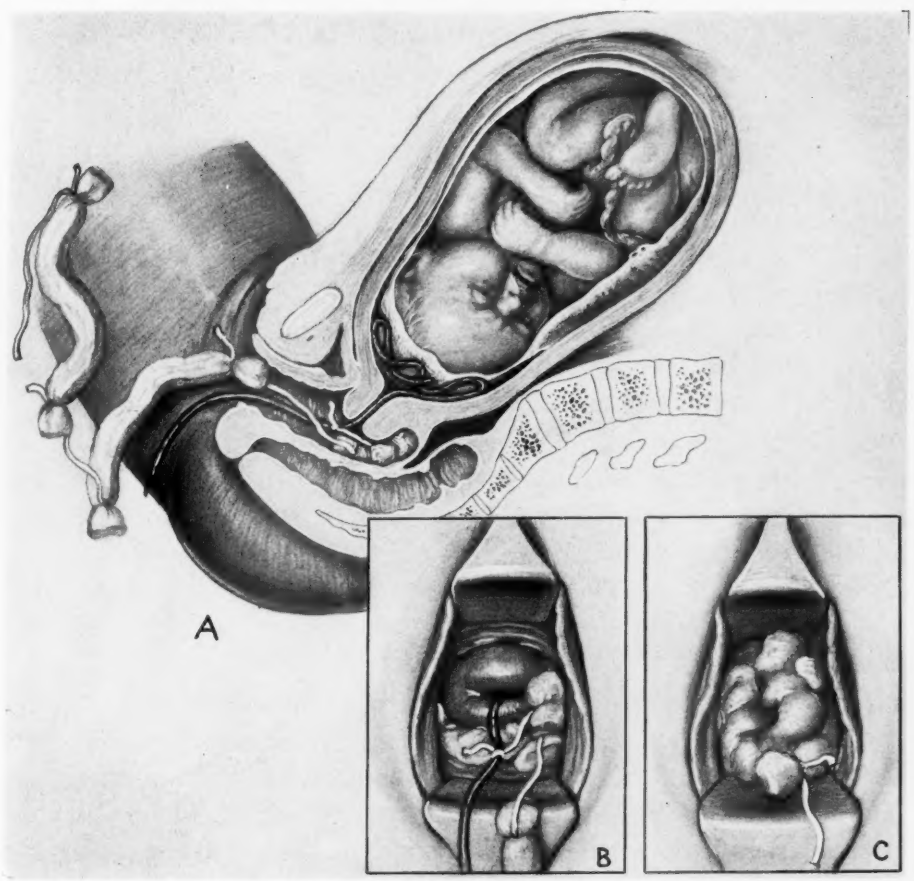


FIG. 2. Author's method of induction of labor. A, sagittal section. Observe outline of uterus, membranes, placenta and fetus. No. 18 to 20 French, soft rubber bougie introduced extraovularly into cervix. It is curled upon itself in lower uterine segment, indenting membranes without rupturing them. A piece of tape is tied to the distal end of the bougie and to the proximal end of a strip of cotton 15 cm. long, 2 cm. wide. A series of cotton strips and tape joined in this manner and arranged in a chain is wrung out in a weak lysol solution and forms a firm packing for vagina. Last piece of tape extends from vagina to insure easy removal of entire packing. B, packing of vagina. C, vagina firmly packed with successive strips of cotton. The tape attached to distal end of last strip extends from the vagina.

The packing may be left in place from twelve to seventy-two hours, provided that every twelve to twenty-four hours 4 per cent mercurochrome is injected into the vagina to prevent as far as

possible the growth of micro-organisms and decomposition in the packing. This can be done by introducing the nozzle of a glass syringe filled with mercurochrome between the strips of cotton and

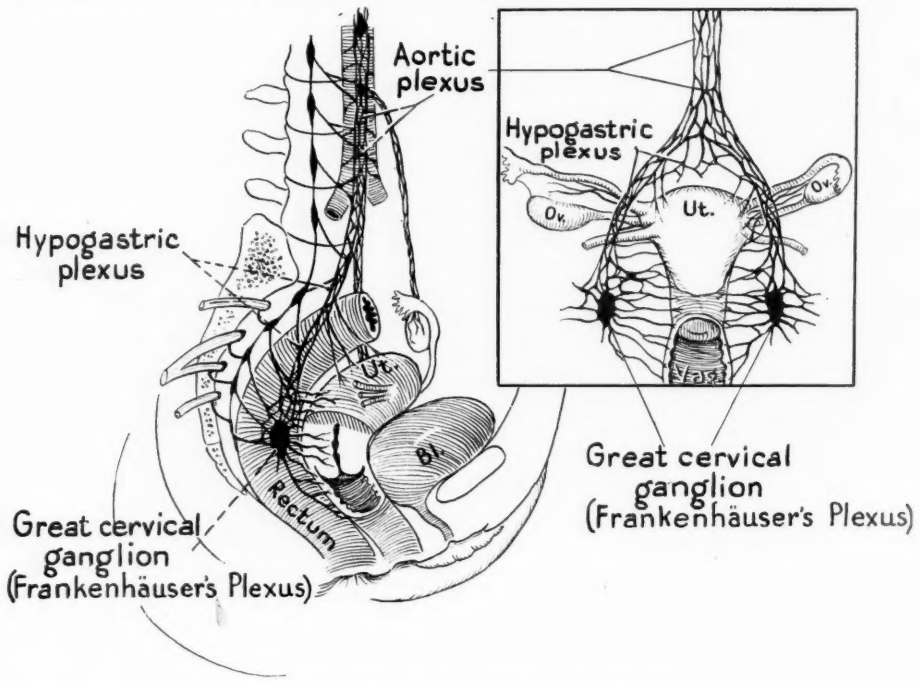


FIG. 3. The innervation of internal genitalia.

squirting the antiseptic among them, whereupon the fluid will, by capillary attraction, become distributed in the cotton strips. Furthermore, the solution, being absorbed by the cotton after the manner of a sponge, will distend the cotton packing, which will then exert greater pressure. If one desires, one may, while packing the vagina with the cotton strips, introduce a soft-rubber catheter high up within the vagina and inject the antiseptic through the catheter, so that by gravity the fluid will work its way downward and distribute itself in the packing. By using this technique, repacking becomes unnecessary.

As has already been pointed out, the effect of this vaginal packing is to make direct pressure on the great cervical ganglia of Frankenhäuser, which, coming from the hypogastric plexus, supply the uterus with its motor innervation and are thus closely associated with the induction of labor. First of all, the bougie within the cervix acts as a foreign body, stimulating these ganglia from inside the cervix. Its action is then reinforced and supplemented by the cotton

packing, which, firmly wedged into the fornices and against the cervix, furnishes a further stimulus for the setting up of uterine contractions, by its counterpressure against these important ganglia.

Labor will usually start within a few hours. Upon removal of the packing, the ovum will either follow directly or will be expelled after a brief interval. Anesthetics are seldom required during packing and only rarely during the expulsion of the ovum.

Should the patient have strong pains at the beginning of labor, at a time too early for the cervix to have dilated or for the ovum to have separated, pain may be relieved by the removal of one or two pieces of packing. This is accomplished without the use of instruments. One merely pulls at the tape and a piece of packing will be drawn out. Only in rare instances must packing be repeated. If this method is employed for placenta previa, it not only staunches the bleeding by compressing the sinuses, but also favors the induction of labor.

It should be emphasized again that when the packing is done for placenta previa, whether to control the bleeding or to induce labor, the application of the volsella to the cervix should be avoided. Also, ample time should be allowed for the presenting part to be delivered through the cervix before removing the entire chain of cotton strips. It is preferable to allow the presenting part to push out the packing. If this technique is carried out, failures are infrequent.

DISCUSSION

This method is particularly indicated in cases of placenta previa where there is a nonviable infant, and the placenta is centrally located. It would be the best kind of treatment, however, even in a case of this kind with a viable infant, if there are serious contraindications to cesarean section. In a case with a total (central) placenta previa and a viable fetus, in which the mother is too depleted from loss of blood to undergo a cesarean section, notwithstanding transfusion, this method should be considered until the patient recovers from shock and the choice of a method of delivery is decided upon.

The advantages of this method in placenta previa are many. It is easy and painless; it avoids shock at a time when the patient is ill able to face further shock; and it requires almost no instrumentation. It can be carried out in any country home without conveniences, where it should be of service in emergency when immediate attention is necessary.

In any case in which it is used, however, of whatever type, exactitude of technique is essential for its success. The cervix must be brought into full view, with or without use of a volsella; if the latter is employed, great importance attaches to the slow and careful use of the instrument, locking the teeth in, one at a time, to avoid laceration and pain. The same care is required in the introduction of the bougie, which should be about the size of a pencil and of soft rubber, to adapt itself to the cervical canal and lower uterine segment, into which it must be inserted with all gentleness. Once within the cervix or lower uterine segment, its action is that of a foreign body. A hard bougie is dangerous in the midst of such friable tissues, especially in placenta previa, and may increase the hemorrhage.

In packing the vagina it is not enough to make pressure upon the cervix. The cotton strips must be packed tightly into the fornices and held there by the strips lower down within the vagina which produce counterpressure. The cotton strips have the advantage over gauze in that they are easier to adapt to the vagina and as labor progresses, the strips may be removed gradually. They are superior to the separate pledgets used by some accoucheurs in that they cannot get lost within the vagina and thereby cause future trouble.

When the packing is completed, the patient can rest. If the case is one of placenta previa, there is now no bleeding, no need for haste, and the accoucheur can wait at his ease for dilatation to occur. Under supportive measures, such as transfusion, glucose in saline, and suitable medication, the patient recovers from the shock of her hemorrhage and regains strength for her delivery. However, the patient should at no time be left alone until delivery is completed and even thereafter she should be watched closely.

As a rule, the further loss of blood is negligible, and labor proceeds normally. When the pains become effective and the cervix is fully dilated, the bougie and the entire packing may be expelled together, followed quickly by the placenta, fetus and membranes, as occurred in a case here recorded. (See Figs. 6 and 7.)

CASE REPORTS

The following three cases are reported to illustrate how the indications may differ in individual cases. In the first, where the placenta previa was partial with a viable fetus, simple rupture of the membranes was sufficient. In the second, where the previa was

total (central) with a viable fetus and no contraindications, a cesarean section was performed at term. In the third, with a nonviable fetus and a total (central) previa, the author's method was used.

FIG. 4. Marginal placenta previa revealed by cystogram after injection of urinary bladder with 12½ per cent solution sodium iodide. Prone position. Membranes ruptured artificially. Living child obtained after thirty-six weeks of pregnancy.

CASE 1. L. M., age 37, multipara 2, was admitted to hospital November 24, 1938, at 3 P.M., complaining of vaginal bleeding of one-half hour's duration, two vulval pads being well soaked during this time. She had had no pains.

The menses had begun at 12 years, were of twenty-eight day type and seven days' duration. Her last period had been March 17, 1938. Computed date of labor was December 22, 1938.

Examination revealed a vertex presentation of the fetus in R.O.T. position; fetal heart in right lower quadrant, 140, of good quality. The head was not engaged, and the fetus was judged to be about eight months old. Blood pressure was 96/66, blood count and urine normal. A cystogram revealed the presence of a marginal placenta previa.

At 5 P.M. a vaginal examination revealed the cervix to be one finger dilated and not effaced. The fetal heart was heard in the right lower

quadrant. A piece of placenta was felt covering the posterior and right side of the os, evidently attached to the posterior and right lateral portion of the lower uterine segment and cervix. The membranes were ruptured artificially on the left side, whereupon meconium-stained liquor amnii gushed out, thus corroborating the diagnosis that the placenta was absent on the left side, but occupied the right posterior side. Thymophysin 0.12 Gm. for three doses was given every 15 minutes.

At 6 P.M. the head was fixed in the inlet, pain irregular. At 8 P.M. the pains were strong. Rectal examination revealed the head to be well engaged, the cervix three fingers dilated, and the presence of many large varicose veins of the vagina. The patient had only a few strong contractions and delivered at 8.10 P.M. a thirty-six week female baby (right occipito-anterior position). Placenta and membranes were expelled intact. There was a blood loss of 200 c.c. from the uterus and the ruptured vaginal varices. The patient did not require any blood, though a donor was prepared. She received ergotrate and 750 c.c. of 5 per cent glucose in saline intravenously. The condition of both child and mother was good. The maternal pulse was 98.

The patient ran an uneventful postpartum course except for a temperature rise to 102°F. on the first and third days postpartum. The elevation might have been due to the ligated varicose veins and iodoform vaginal packing.

Comment. In this case the patient had been bleeding for only one-half hour before the taking of the cystogram which revealed a marginal placenta previa on the right side. The pregnancy was known to have reached eight months; the baby was therefore viable. Vaginal examination revealed a cervix dilated to one finger, and a piece of placenta covering the posterior and right side of the os, clearly attached to the lower uterine segment and cervix. On the basis of these findings the membranes were ruptured at a safe place on the other side of the os. The patient was delivered three hours later of a thirty-six week female child. The case illustrates how the roentgenogram guides to a safe point for puncture of the membranes.

CASE II. J. W. age 34, married 7½ years, was admitted to hospital August 21, 1938, complaining of vaginal bleeding on the previous day and during the night. One normal pregnancy and labor had occurred six years previously.

The menses began at 14 years, were of twenty-eight day type and of five days' duration, moderate flow. The last menses had been January 12, 1938, and the computed date of labor was October 19, 1938.

The patient began to bleed eight weeks before term and was admitted to the hospital. A cystogram was taken and the diagnosis of total (central) placenta previa was made. After the bleeding stopped, she was kept quiet

FIG. 5. Placenta previa total (central). Menstrual age 222 days or thirty-one weeks and five days. Bladder injected with 40 c.c. 12½ per cent solution sodium iodide. Note distance of skull to shadow of bladder (over 2 cm.).

without interference. She was typed and donors were prepared for an emergency.

When she reached term, a cesarean section was done, October 19, 1938, and a living male child delivered. A centrally located placenta was found. The uterus was packed with iodoform gauze.

The postpartum course was uneventful.

Comment. In this case the diagnosis was made by the cystogram, which suggested a placenta previa totalis (centralis). Bleeding had begun on the day preceding admission. The exact date of conception was known. The plain roentgenogram revealed a pregnancy

of seven months, on the basis of fetal ossification. The patient was typed and donors were kept in readiness, in case of emergency. As there was no more bleeding, however, she was kept very quiet,

FIG. 6. Cystogram in case of placenta previa total (central). Apparent age of fetus six and one-half months. Note distance between fetal head and bladder shadow. Fetal skull slightly retouched.

supervised closely, and delivery was delayed until a viable child was assured. At term a cesarean was done and a live male child delivered. A total placenta previa was found, confirming the Roentgen diagnosis. The case illustrates the advantage of a cesarean operation in a case of placenta previa totalis without contraindications.

CASE III. P. F., colored, age 26, was admitted February 2, 1939, complaining of irregular lower abdominal pains and vaginal bleeding that had persisted for two days.

The menses began at 13, occurred every twenty-eight days and were of three to five days' duration, always regular and without pain. Amenorrhea had been present since birth of the patient's second child, eleven months

previously. Two previous pregnancies were both normal; no miscarriages and no abortions were reported.

One month prior to admittance the patient had had a similar attack of vaginal bleeding for two days, but without pain.

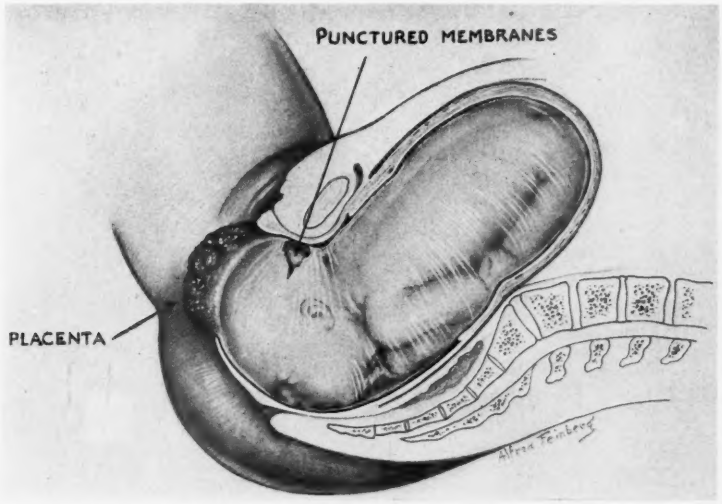


FIG. 7. Schematic drawing. Sagittal section through uterus and pelvis, showing birth of placenta followed by fetus, enveloped in membranes. Rent in anterior margin of membranes indicates site of artificial rupture.

On examination she did not appear acutely ill. The abdomen was enlarged to about a seven months' pregnancy with the fetus in the left occipito-anterior position. Fetal heart sounds were heard in left lower quadrant. The patient was spotting slightly from the vagina. Blood pressure was 120/80, the urine negative, hemoglobin 65 per cent and red blood cells numbered 3,790,000.

A cystogram showed that the distance between the head and the bladder was very wide, suggesting the presence of a centrally located placenta. The *x*-ray conclusion was placenta previa, central implantation.

During the taking of the cystogram a gush of blood came from the vagina and the patient began to bleed profusely without pain. The pulse rose to 120 and became thready. She was given a transfusion of 500 c.c. of blood by indirect method, followed by intravenous fluids.

A soft-rubber bougie was inserted into the cervix, together with a vaginal packing of 15 cm. long strips of cotton wrung out in ½ per cent lysol. Each strip was connected to the next with tape in such a manner that they formed a chain (*author's induction method of labor*). This controlled the bleeding.

About two hours later the patient began to have intermittent lower abdominal pain. Thymophysin 0.12 Gm. every thirty minutes was given for

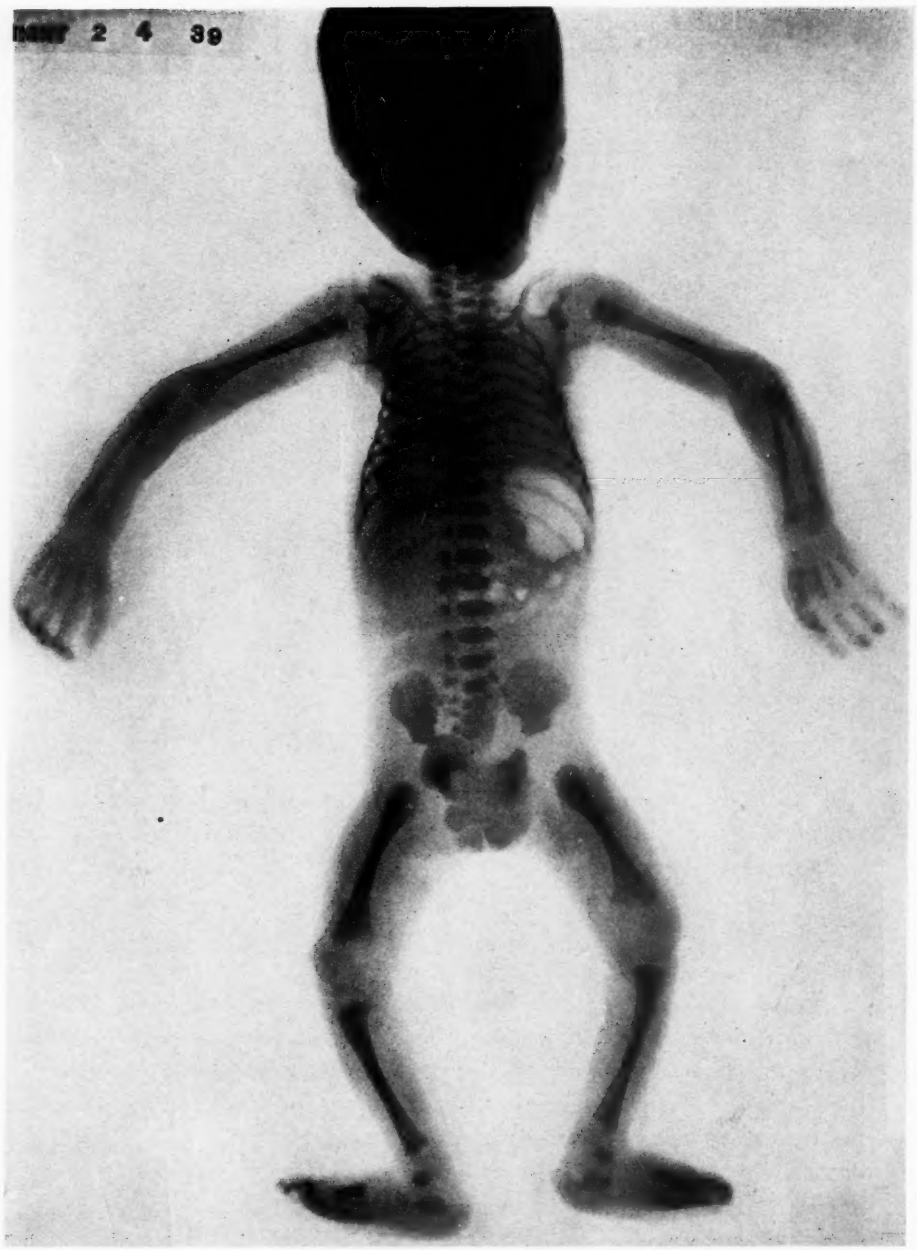


FIG. 8. Length of fetus 32.5 cm. Weight 750 Gm. Exact menstrual age not known as patient conceived two months postpartum and did not menstruate after delivery. Ossification centers of transverse processes of all lumbar vertebrae evident. Astragulus well formed; thus age is more than twenty-four weeks (between twenty-five and twenty-six), and less than twenty-eight or twenty-nine weeks, as greater cornua of hyoid bone are absent.

four doses, when the patient began to have stronger pains, followed by bearing down pains. She expelled the vaginal packing and bougie together. The placenta presented and was delivered completely before the fetus was seen. The membranes presented themselves under the pubis. A finger was insinuated under the pubis and the membranes ruptured. Labor progressed without bleeding. The entire ovum, placenta, fetus and membranes were delivered in one mass. A six and one-half months' old fetus in the sac was delivered by vertex presentation, stillborn. The blood loss throughout the procedure was not over 100 c.c. During delivery the patient was given intravenous injections of glucose in saline continuously (750 c.c.). As labor was being terminated, another transfusion of 200 c.c. of blood was given. Notwithstanding that the patient was not bleeding, the vagina was exposed and packed with iodoform gauze.

The postpartum course was uneventful, and the patient was discharged on the fourteenth day in good condition.

Comment. In Case III, the author's method was used successfully for induction of labor in a case of placenta previa totalis with a nonviable fetus of six and one-half months, as revealed by roentgenogram of the fetus. A study of the ossification centers from the roentgenogram of the fetus after its delivery indicated that its estimated age was correct and that it would not have survived even if delivered by cesarean section.

The patient received a transfusion before the bougie and packing were introduced, intravenous glucose in saline during delivery and a second transfusion as labor was terminated. It is worthy of note that with the exception of loss of blood when the cystogram was taken, the patient lost less blood throughout the entire procedure than occurs in a normal case, and that at its close no bleeding was present.

The method I have described for premature induction of labor is equally applicable in cases of abnormal uterine bleeding due to other causes than placenta previa, and in cases in which, for any reason, therapeutic abortion is indicated. Cases IV and V are illustrative of its use under such conditions.

CASE IV. P. T., Porto Rican, age 29, was admitted to hospital April 11, 1939, complaining of continuous vaginal bleeding and intermittent lower abdominal and back pains of varying severity since March 6, 1939. She had not noted the passing of fleshy or blood clots.

The menses began at 12 years, were of twenty-eight day type and of three days' duration. The last normal period began November 10, 1938

and amenorrhea had been present from that time until the present episode of bleeding started. She was a multipara 4, gravida 4, who had had normal and spontaneous deliveries. The last delivery had been in June, 1938.

FIG. 9. Negative cystogram in normally implanted placenta.

On admittance an elastic mass was felt, extending from the pubis to a point halfway between the umbilicus and the ensiform process. It was freely movable, nonsensitive, and contiguous with the uterus. A diagnosis of ovarian cyst was made. The *x*-rays showed the presence of a pregnancy of approximately five months. The Aschheim-Zondek test was positive. The diagnosis of a threatened abortion was then made. The menstrual age of the fetus was approximately 154 days. Urine and blood count were normal.

At 10 A.M. on April 18, induction of labor was done (author's method). Also, quinine hydrochloride, 3 gr., was given by mouth at hourly intervals for three hours. A soapsuds enema and an injection of pituitrin 0.12 were

FIG. 10. Negative cystogram in normally implanted placenta.

given. The pituitrin was repeated one hour later. At night the patient was given seconal, 3 gr., and slept well. On the morning of April 19, the quinine and pituitrin series was repeated. The patient complained of severe lower abdominal pains, but no definite contractions were felt. She was given rest at night by administration of seconal, 1½ gr. At 8 A.M. on the morning of the 20th, the patient delivered spontaneously a five months' fetus. This was forty-seven hours from the time the induction of labor was begun. An uneventful afebrile course followed and the patient was discharged eight days postpartum. The uterus was still large but firm, even at the time of her discharge. A uterine fibroid remained present.

Comment. In Case IV, the author's method of induction of labor was employed in a case of vaginal bleeding from a pregnant uterus, complicated by a fibroid. The woman was approximately five months' pregnant, as revealed by *x*-rays, and a diagnosis of threatened abortion had been made. Quinine hydrochloride and small doses of pituitrin were administered at intervals. The labor thus induced was terminated spontaneously forty-seven hours after the beginning of induction.

CASE V. R. P., age 39, a multipara 3, with one living child, was admitted May 18, 1939.

Her first menses began at 14, were of twenty-eight day type, duration five days. The last menses had occurred February 13, 1939.

The patient had a hematogenous neoplasm of the lung which had not been arrested by Roentgen therapy three years previously. She was pregnant at that time, and an induction of labor was done (author's method), because of the existing neoplasm. The patient again became pregnant against the advice of physicians, due to her eagerness for a child, and because of the fact that she had lost two of her three children. She pleaded to be allowed to carry out this pregnancy, but in view of her condition her physicians deemed it inadvisable.

On May 19, 1939, the day following admission, a soft bougie was inserted and she was packed with strips of cotton (*author's method of induction of labor*). On that day, 2 ounces of castor oil were given at 8 A.M. and 3 gr. quinine at one-hour intervals: 9, 10 and 11 A.M. A soapsuds enema was given one hour after the last dose of quinine. The patient began to have pains at 1.30 A.M. on May 21, and expelled the fetus and membranes at 2.45 A.M., approximately forty-two hours after treatment was begun.

Comment. In Case V, the author's method of induction was used to terminate a pregnancy for the second time, in a patient in whom a hematogenous neoplasm of the lung had not been arrested by Roentgen therapy. Notwithstanding her desire to carry out this pregnancy, she was advised by her physicians to permit its termination, in view of her unfavorable condition, due to the existing neoplasm. Labor terminated spontaneously forty-two hours after its induction was begun.

When the author's method of induction of labor is used in placenta previa, the entire packing is removed at one time, provided it is not expelled in a mass spontaneously. However, when the method is employed to terminate a pregnancy for other reasons, it may be useful to remove the strips more gradually, one fold at a

time. If the patient should have strong pains during the beginning of labor, too early for the cervix to be dilated or for the ovum to have separated, the pressure may be relieved by removal of one or two pieces of packing. This is accomplished without the use of instruments. One merely pulls at the tape and a piece of packing will be drawn out. Only in rare instances must the packing be repeated.

SUMMARY AND CONCLUSIONS

1. Improved means of diagnosis have made it possible to recognize placenta previa at the first bleeding, and to distinguish *partial* and *total* previas in the cystogram.

2. Roentgenographic studies will indicate the presence of monstrosities; also, the centers of ossification in the fetus reveal in advance whether it is viable.

3. The knowledge thus obtained enables the accoucheur to choose the method of treatment best suited to the individual case, without loss of time and blood.

4. The various methods of treatment are evaluated.

5. In inducing labor, the importance of stimulating the onset of labor by making direct pressure upon Frankenhäuser's great cervical ganglion is emphasized.

6. The author presents a method of inducing labor, based on this principle, and describes his technique, which he has employed for over twenty-five years, and which he believes should be considered in carefully selected cases, and in some cases of placenta previa.

7. Five illustrative cases are reported.

REFERENCES

ADAIR, F. L. Discussion of Aldridge and Parks. See following reference.

ALDRIDGE, A. H., and PARKS, T. J. End results in 400 cases of placenta previa. *Am. J. Obst. & Gynec.*, 36: 859, 1938.

BAUMM, P. Ballonbehandlung mit tierischen Blasen. *Deutsch. med. Wchnschr.*, 39: 1201, 1913.

BECK, A. C. Obstetrical Practice, 2nd Ed., p. 690. Baltimore, 1939. Williams & Wilkins.

BECK, A. C., and LIGHT, F. P. *X*-ray diagnosis of placenta previa. *Am. J. Obst. & Gynec.*, 35: 1028, 1938.

BILL, A. H. Treatment of placenta previa by prophylactic blood transfusion and cesarean section. *Am. J. Obst. & Gynec.*, 14: 523, 1927.

BLAND, P. B., and MONTGOMERY, T. L. Practical Obstetrics for Students and Practitioners, 1st Ed., p. 208. Philadelphia, 1932. Davis.

BRUNNER, E. The insertion of the placenta over the internal orifice of the uterus. Thesis, 1730.

DAILY, E. F. Maternal deaths, a brief report of a study made in 15 states. U. S. Dept. Labor, Bureau Publication #221. Washington, D. C., 1933. Government Printing Office.

DAILY, E. F. Placenta previa. *Surg., Gynec. & Obst.*, 59: 106, 1934.

DANFORTH, W. C. Placenta previa. *Am. J. Surg.*, 35: 436, 1937.

DAVIS, A. A. Innervation of uterus. *J. Obst. & Gynaec., Brit. Emp.*, 40: 481, 1933.

DAVIS, M. E. Placenta previa. *Surg., Gynec. & Obst.*, 68: 504, 1939.

DELEE, J. B. Principles and Practice of Obstetrics, 7th Ed., pp. 512, 522, 1028, 1165. Philadelphia, 1938. Saunders.

DELEE, J. B. Editorial comment on Willett method. Yearbook of Obst. & Gynec., 1937, p. 235.

VAN DEVENTER, H. Observations importantes sur le manuel des accouchemens, Paris, 1734.

DORLAND, W. A. N., and HUBENY, M. J. The X-ray in Embryology and Obstetrics. London, 1926. Kimpton.

Editorial. Unavoidable hemorrhage. *J. Obst. & Gynaec., Brit. Emp.*, 43: 393, 1936.

EKAS, W. L. Treatment of placenta previa by conservative measures. *New York State J. Med.*, 36: 341, 1936.

FINDLEY, D. Management of placenta previa; analysis of 47,828 cases. *Am. J. Obst. & Gynec.*, 36: 267, 1938.

FRANKENHÄUSER, F. Die Nerven der Gebärmutter und ihre Endiging in den glatten Muskelfasern: Ein Beitrag zur Anatomie und Gynäkologie. Jena, 1867. F. Mauke.

FREY, E. Die Bedeutung der Lokalanästhesie für die abdominale Schnittentbindung. *Zentralbl. f. Gynäk.*, 52: 2485, 1928.

GIFFARD, W. Cases in Midwifery, Revised and Published by Edward Hody. London, 1734.

GREENHILL, J. P. Pathology of Pregnancy. In: Practitioners Library of Medicine & Surgery, 6: 241–399. New York, 1934. D. Appleton-Century.

HESS, J. H. The diagnosis of the age of the fetus by use of roentgenogram. *Am. J. Dis. Child.*, 14: 397, 1917.

HIPPOCRATES. De Morbis Mulierum, Lib. 1 (cited by Read, p. 13). See reference for William Read.

IRVING, F. C. A study of 308 cases of placenta previa. *Am. J. Obst. & Gynec.*, 32: 36, 1936.

JARCHO, J. Gynecological Roentgenology: A Roentgen Atlas of the Female Generative Organs with Special Reference to Uterosalpingography, p. 461. New York, 1931. Hoeber. Also *Ann. Roentgenol.*, vol. 13.

JARCHO, J. The Pelvis in Obstetrics: A Practical Manual of Pelvimetry and Cephalometry including Chapters on Roentgenological Measurement, pp. 27, 282. New York, 1933. Hoeber.

KERR, J. M. MUNRO. Operative Obstetrics, 4th Ed., pp. 21, 707. London, 1937. Baillière, Tindall & Cox.

KERR, J. M. MUNRO, and MACKAY, W. G. The diagnosis of placenta praevia, with special reference to the employment of *X*-rays for this purpose. *Tr. Edinburgh Obst. Soc.*, pp. 21–32, 1932–1933, in *Edinburgh M. J.*, March 1933.

KLEIN, P. Unsere Erfahrungen mit der Prokteuryse. *Zentralbl. f. Gynäk.*, 50: 2493, 1926.

LA VAKE, R. T. Hemorrhage in obstetrics. *Minnesota Med.*, 18: 4, 1935.

LEVRET, A. L'art des accouchemens, démontré par des principes de physique et de méchanique, pour servir de base et de fondement à des leçons particulières. Paris, 1753.

MACKENZIE, L. L. Statistical study of treatment of placenta previa. *Am. J. Obst. & Gynec.*, 33: 577, 1937.

MARSHALL, C. H. Method in treatment of placenta previa (Report of Societies). *Brit. J. Obst. & Gynaec.*, 42: 199, 1935.

MAURICEAU, F. The Diseases of Women with Child and in Child-bed, translated by Hugh Chamberlin. London, 1752.

MCIVER, J. Use of the cystogram in diagnosing placenta praevia. *Texas State J. Med.*, 32: 471, 1936.

MENEES, T. O., MILLER, J. D., and HOLLY, L. E. Amniography; preliminary report. *Am. J. Roentgenol.*, 24: 363, 1930.

MORTON, D. G. Anatomic description of a case of marginal placenta previa, with a discussion of the etiologic implications. *Am. J. Obst. & Gynec.*, 33: 547, 1937.

NOVAK, J. Beziehungen zu Nervensystem und Genitale. In Biologie und Pathologie des Weibes (Halban-Seitz), Vol. 5, p. 1394, 1924.

OERTEL, O. Anatomie, Histologie und Topographie des weiblichen Urogenital-apparatus. In: Biologie und Pathologie des Weibes (Halban-Seitz), Vol. 1, p. 327, 1924.

PARKS, T. J. See reference for Aldridge and Parks.

PORTAL, PAUL. La practique des accouchemens soutenue d'un grand nombre d'observations. Paris, 1685. G. Martin. Note: Quotation from English translation, author not known. London, 1705. S. Crouch & F. Taylor. (Cases 39, 41, 43 and 51.)

PRENTISS, R. J., and TUCKER, W. W. Cystography in diagnosis of placenta previa. *Am. J. Obst. & Gynec.*, 37: 777, 1939.

READ, W. Placenta Praevia; Its History and Treatment. Philadelphia, 1861. Lippincott.

RENTON, R. Remarks on the literary history of uterine hemorrhage, proceeding from attachment of the placenta to the os uteri. *Edinburgh M. & S. J.*, 48: 245, 1837.

RIGBY, E., the elder. Essay on the Uterine Haemorrhage, 1st Ed., p. 15. London, 1775. Joseph Johnson.

SCHEHL, E. Zur Behandlung der Placenta praevia mit der Kopfschwartenzange. *Zentralbl. f. Gynäk.*, 61: 2504, 1937. Abstr., Year Book of Obst. & Gynec., 1937, page 234.

SCHUMANN, E. A. A Textbook of Obstetrics. Philadelphia, 1936. Saunders.

SIEGEL, I. A. Observations on 101 cases of placenta previa delivered by abdominal Cesarean section. *Am. J. Obst. & Gynec.*, 27: 889, 1934.

SMELLIE, W. Treatise on Midwifery. London, 1743.

SNOW, W., and POWELL, C. B. Roentgen visualization of placenta. *Am. J. Roentgenol.*, 31: 37, 1934.

STANDER, H. J. Williams Obstetrics. 7th Ed., p. 1109. New York, 1936. D. Appleton-Century.

STOECKEL, W. Lehrbuch der Geburtshilfe. 5th Ed., pp. 23, 968. Jena, 1938. G. Fischer.

STRASSMANN, P. Placenta praevia. *Arch. f. Gynäk.*, 67: 112, 1902.

TAUSSIG, F. J. Abortion, Spontaneous and Induced: Medical and Social Aspects, p. 338. St. Louis, 1936. Mosby.

THOMPSON, W. B. The treatment of placenta previa, together with anatomical description of two specimens. *Bull. Johns Hopkins Hosp.*, 32: 228, 1921.

TITUS, P. The Management of Obstetric Difficulties, p. 291. St. Louis, 1937. Mosby.

TRILLAT, P. Le shock obstétrical mortel. *Bull. Soc. d'obst. et de gynéc.*, 25: 714, 1936.

UDE, W. H., and URNER, J. A. Roentgenologic diagnosis of placenta previa. *Minnesota Med.*, 18: 9, 1935; *Am. J. Obst. & Gynec.*, 29: 667, 1935.

UDE, W. H., WEUM, T. W., and URNER, J. A. Roentgenologic diagnosis of placenta previa; report of case. *Am. J. Roentgenol.*, 31: 230, 1934.

UDE, W. H., URNER, J. A., and ROBBINS, O. F. Roentgenologic diagnosis of placenta previa; indirect placentography. *Am. J. Roentgenol.*, 40: 37, 1938.

VAUX, N. W. Discussion: See reference for Aldridge and Parks, p. 874.

VIGNES, H., and TISSERAND, M. La méthode de Willett dans le traitement du placenta praevia. *Gynéc. et. obst.*, 35: 54, 1937. Abst., Year Book of Obst. & Gynec., 1937, p. 234.

WESSEL, J. N. De partu cum haemorrhagia ob placentam orificio uteri adhaerentem, 1753.

WILLETT, J. A. Method in treatment of placenta previa. Year Book of Obst. & Gynec., 1937, p. 234. See also reference for Marshall, p. 199.

WILLIAMS, J. W. Obstetrics, 7th Ed., (revised by H. J. Stander). New York, 1936. D. Appleton-Century Co., p. 1108.

ADDITIONAL REFERENCES*

CALDERA, R. Placenta praevia. *J. Obst. & Gynaec., Brit. Emp.*, 46: 531, 1939.

PENROSE, L. S. Maternal age and parity in placenta praevia. *J. Obst. & Gynaec., Brit. Emp.*, 46: 645, 1939.

* Appeared after preparation of this monograph was completed.